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a review of general semantics

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SUCCESSIVE LEVELS OF MATERIAL STRUCTURE*

JEROME ALEXANDER

[FOREWORD BY A. KORZYBSKI: Jerome Alexander, a chemical engineer and consulting chemist, is one of the most outstanding specialists in colloid chemistry, not only in America but also other continents. Probably there is no country in the world in which colloid chemistry is taught where scientists are not familiar with his name and professional contributions. Among others, he translated *Colloids and the Ultramicroscope* by Professor Richard Zsigmondy in 1909, and became a pioneer worker in ultramicroscopy in this country. In 1919 he published his *Colloid Chemistry* which passed through a number of editions. Other papers and contributions to books by Alexander are too numerous to mention here.

Because of his vast experience, knowledge, and interest in the subject of colloids, he was invited in 1922 to collect and edit the monumental volumes on colloid chemistry by international contributors. This work put him in contact with the world leaders in that science embracing every kind of applications, which no single specialist could master. His work as editor required practically a specialization in a great many specific yet related fields, which in turn broadened his physico-mathematical and electro-colloidal knowledge. While doing this gigantic work, which is reinforced throughout by his broad human educational feelings, Alexander began to see clearly that one of the main needs for humanity, if it is ever to absorb that endless wisdom, is a *general structural analysis;* for, as we know, the content of all human knowledge is structural only.

The title of his introductory chapter in the first volume of *Colloid Chemistry* was 'The Sub-Microscopic Structure of Matter.' His introductory chapter in the second volume, written together with my friend the late Dr. Calvin B. Bridges, was on 'Some Physico-Chemical Aspects of Life, Mutation, and Evolution.' And finally, his introductory chapter for the forthcoming fifth volume, printed here, deals with 'Successive Levels of Material Structure,' which shows clearly the *orders of complexity* that arise on different levels of structure. It appears that what we 'see,' that is, what we are able to perceive on the macroscopic level, is of the highest order of complexity. The human tragedy was and is that the infant, the average person, and even most scientists, following primitive traditions, evaluate in daily life the 'seen' as the 'simplest,' without taking into consideration the 'unperceived' complexities discovered by science.

* The editors express their gratitude to the author and the publisher for their kind permission to publish this article, which is the introductory chapter in the fifth volume of *Colloid Chemistry*, edited by Jerome Alexander, and to be published shortly by the Reinhold Publishing Corporation, New York City. A review-article by Alfred Korzybski of this forthcoming volume will be published in the next issue of *ETC.*

They forget, or do not know, the profound statement of Santayana that, 'The empiricist . . . thinks he believes only what he sees, but he is much better at believing than at seeing.'

Whitehead said, 'The aim of science is to seek the simplest explanations of complex facts. . . . Seek simplicity and distrust it.' Alexander in his table of orders of complexity illustrates that statement, which is correct. Yet the average person takes in daily life the most complex as the 'simplest,' *and trusts it.* No wonder that the whole world is hopelessly bewildered, scientists included.

Alexander's editorial work requires quite unique and profound knowledge of a very complex subject, which today permeates, among others, every phase of life, biology, physiology, neurology, medicine in general, including psychiatry, etc. Anyone who would read only the table of contents of the five volumes of *Colloid Chemistry* would realize that physico-mathematical, and so colloidal, sciences and methods are necessary for the understanding of astronomy, meteorology, surface energies, ultramicroscopy, pharmacology, viruses, bacteriophages, insemination of ova, cancer, syphilis, concretions in gall bladders and kidneys, tumors, allergies, organic evolution, heredity, the process of aging, and whatnot! As my own readers know, a dynamic, sub-microscopic orientation is also fundamental for non-aristotelian evaluations — and *vice versa.*

I mention these few aspects of the importance of colloids because it is not realized what heavy methodological implications are involved in electro-colloidal orientations. There is no doubt, as Wolfgang Pauli said, 'To-day colloids may be regarded as an important, perhaps the most important connecting link between the organic and the inorganic world,' and so gradually many 'mysteries' of life cease to be mysteries. We begin to see how structure and function may overlap. For instance, when we are still in the stage of a fertilized ovum, and this applies to every one of us, we do not have internal organs or arms or legs; but the *electro-colloidal potentialities* are there as electro-dynamic *functions* which ultimately produce the *structures* that you and I know from experience. Even the great enigma of 'body,' 'mind,' etc., and so psychosomatic medicine, becomes intelligible.

The farther we advance in the understanding of the orders of complexities, the better we can evaluate the endless number of possibilities in life processes. Here comes a tragic paradox: biologists, etc., and medical specialists, know a great deal about electro-colloidal behavior; however, they are unable to apply the knowledge they have to the complexities of living problems because of lack of general non-aristotelian methods of evaluation. To quote Alexander, 'No simple explanation, formula, or group of formulas, will ever explain the behavior of even a single ameba,' which obviously is a much less complex electro-colloidal structure than humans, with corresponding differences in behavior. Yet even our specialists try to solve the most complex problems in this world using thoroughly inadequate two-valued ('either-or'), etc., antiquated aristotelian methods, which lead usually to individual, national and international disasters. Works of men like Alexander and his colleagues, and a great many other specialists, make it obvious that the only solution for adjustment to the world as we know it scientifically today is to revise our everyday macroscopic, inflexible, static orientations, which may be called aristotelian or pre-scientific, to scientific 1944, sub-microscopic, dynamic, process, flexible, etc., orientations. The formulation of

such a revision turns out to be a non-aristotelian *system,* teachable through simple methods even to children.

Today there is no way to understand and manage the bewildering diversified array of known facts unless we first get conscious of *structure,* then *orders* of complexity of *dynamic structures,* and finally of the increasing complexities when dynamic structures begin to be *superimposed* upon, and *interact* with, other dynamic structures. With this consciousness we discover simple extensional methods of evaluation, which become generally teachable without technicalities.*

As Alexander puts it in the preface to the first volume of *Colloid Chemistry:* 'Besides its usefulness, there is a nobility in the classified knowledge we call Science. In the Bible (*Proverbs* 25, 2) it is stated: "It is the glory of God to conceal a thing: but the honor of kings is to search out a matter." ' According to the Bible, men like Alexander should be classified with the 'kings.']

THE tangible things with which we deal in our daily lives, and even the smaller units revealed by our microscopes, ultramicroscopes, electron microscopes and x-ray spectrometers, are complexes resulting from the aggregation of still smaller units at successively lower structural levels. William S. Gilbert put a profound truth into the song of 'Little Buttercup' when he wrote: 'Things are seldom what they seem.'

In the early days of science, its great leaders were termed natural philosophers, for their breadth of view was sufficiently wide to enable them to understand, appraise, correlate and extend existing knowledge of natural phenomena in many fields. As the increasing armies of scientists were deployed over an ever-extending scientific terrain, they accumulated masses of detailed information, much of which was reported in localized scientific dialects, buried in *oubliette* journals, and unappreciated by the comparatively few generalists who remained at scientific headquarters. Specialists in various fields developed their own scientific journals and jargon. Botany and zoölogy were estranged. Chemistry and physics became different disciplines and each spawned a numerous progeny of subsidiary sciences. In medicine the general practitioner, who treated whatever ills his patients happened to have, was overshadowed by a host of highly trained specialists who often found patients suffering with the particular ills they treated. This often saved patients; but it might happen that an opera singer could have a hemorrhage on the stage if a throat specialist failed to recognize active lung trouble.

The reaction from over-specialization in science has been steadily proceeding, not by abolition of the special fields and their journals, but by an increasing appreciation of the close and inseparable interrelations among all scientific disciplines. Nature is oblivious of the subdivisions of knowledge created by university departments, by textbooks, or by any hiatus in personal information. A single natural phenomenon, *e.g.,* respiration, may cross the frontiers of biology, physics, organic, inorganic and colloid chemistry. Although this is well known, it all too frequently occurs that specialists whose attention is focused on conditions or happenings at

* The interested reader may find some further material in Chapter IX on 'Colloidal Behavior' and Chapter XLI on 'The Newer Matter' in my *Science and Sanity;* and my paper on 'Some Non-aristotelian Data on Efficiency for Human Adjustment' in the *Papers from the Second American Congress on General Semantics.*

some one structural level, or even limited to that level, fail to notice or fairly to appraise the relations of what they see to facts emerging at other structural levels. Because of educational hysteresis, rapidly advancing scientific discovery is generally far in advance of textbooks, and because of intellectual inertia it is all too often considerably in advance of teachers. Joint meetings and symposia, the development of borderline sciences, reviews and books of broad scope, and splendidly organized and comprehensive abstract journals, offer to all who are willing to make the effort the means of extending both the area and depth of their scientific vision.

Science and Philosophy

Knowledge of isolated facts, important though they may be, cannot be considered as *science,* although legal Latin terms *scienter* mere knowledge of facts that fix responsibility on an individual. The further we go in our efforts to correlate and colligate facts in various fields, the more closely do we approach *philosophy,* which deals with knowledge of the highest generality, *science* representing the intermediate steps of partially unified knowledge. Laboratory apparatus used to be termed 'philosophical instruments,' when scientists were 'natural philosophers.' The 'Philosophical Transactions of the Royal Society' and the 'Transactions of the American Philosophical Society' contain papers in a wide variety of scientific fields. John Dalton, who was the first Secretary of the Manchester Literary and Philosophical Society, was the discoverer of color blindness, from which he suffered, as well as of the law of chemical combination in fixed proportions. It would be unfortunate if scientific specialists who tolerate brethren in remote fields should adopt a supercilious attitude toward philosophers, who put the hard-won facts of science to the uses for which they are intended—further unification. The motto of Phi Beta Kappa, 'Philosophy is the guide or steersman of life,' applies cogently to science.

In dealing with ultimate scientific ideas, Herbert Spencer [1] points out that we can form no real concept of an ultimate unit or particle. To say that matter is infinitely divisible commits us to a supposition not realizable in thought. The other alternative, that matter is *not* infinitely divisible, cannot be represented in thought; for every material unit, despite its minuteness, must be thought of as having a top and bottom and a right and left side, like any larger particle, so that a plane of section can be conceived of between them. Considering motion, if we try to follow mentally the decreasing velocity of a rising pendulum, we cannot pass, in thought, from infinitesimally slow motion to *no* motion. The infinitesimal calculus overcomes this impasse by assuming that motion proceeds in a quantum or dropwise fashion, and that there is a sudden minute jump from $v = ds$ to $v = o$.[2]

Similarly, we can have no notion as to the limits of space. We cannot imagine that space ends with the so-called Einsteinian Universe, estimated at 2×10^9 light-years, a light-year being approximately six million million miles. This estimate is based on our inability to *measure* any greater distance with the aid of light, the only measuring rod at present available. The fact that we cannot *measure* relative velocities greater than the speed of light does not mean that no such velocities exist. As Soddy pointed out,[3] if two particles (electrons) are shot out from a radioactive body in opposite directions and at speeds approximately the speed of light (say nine-tenths c), their

motion relative to each other (1.8*c*) would be nearly double the velocity of light. As E. Cunningham [4] observed, 'This is quite true, and the principle of relativity has nothing to say against it. The principle maintains that a velocity greater than *c* (the velocity of light) *relative to the observer* cannot be observed. . . . The position is not that velocities greater than *c* are not conceivable, but that real bodies become illusory in observation if they are conceived of to be moving faster than light.'

The Relativity of All Knowledge

Spencer devotes the fourth chapter of his 'First Principles' to a discussion of 'the relativity of all knowledge,' and was thus a philosophical precursor of Albert Einstein who demonstrated the relativity of physical measurements. Lest we be too confident of all our sensory knowledge, let it be recalled that Blakeslee and Fox [5] demonstrated that the ability of persons to taste phenylthiocarbamid is heritable as a Mendelian recessive, and that even those who get any taste at all from it (about 70 per cent) describe it variously as bitter, sweet, salty, or sour. This indicates that there is a relativity of sense impressions. H. C. Moir [6] tested sixty persons as to their ability to recognize by taste four simple flavors—orange, lemon, lime, and vanilla. Only one person had a perfect score. Five had records of over 75 per cent, but forty-eight failed to reach 50 per cent. Vanilla was variously identified as black currant, lime, apricot, greengage, damson, lemon, pineapple, orange, tangerine, almond, red currant, strawberry.* Only a limited number of persons can taste sodium benzoate, and wide differences exist in the ability to detect and recognize such odors as verbena and to distinguish between wines.[7] R. J. Williams reports (*Science*, Dec. 11th, 1931) that a man whose sense of smell appeared otherwise normal could not detect the odor of a skunk, while *n*-butyl mercaptan, the 'perfume' carried by skunks, had no unpleasant odor for him. Laselle and Williams [7a] in attempting to identify a substance as creatinine, found it tasteless, though the literature states that creatinine is bitter. It was not until they had tried the sample on several others that they located someone who found it bitter. Since lean meat contains much creatinine (about 2 grams per pound), and soups made from lean meat contain extracted creatinine, we have another possible basis of differences in taste. Williams believes that the problem is associated with the more general one of individual metabolic idiosyncrasies, which crop up at times in medical practice (*e.g.*, reactions to morphine, novocaine, iodoform) or in industry (reactions to cosmetics, 'chemicals,' etc.).

On the other hand the sense of smell of many animals is highly developed. Dogs follow a scent; deer, elk, and most wild animals can be approached only from the lee side. When offered a strange kitten, or sometimes even one of her own that has acquired a 'foreign' odor, a mother-cat, after carefully sniffing it, will 'spit' and box the kitten's ears to drive it off. Bees and ants are largely guided by odor, as are most insects in seeking food or mates. A Swiss scientist who had a female moth caged in his city laboratory far removed from parks or woodland, was astonished to see large numbers of males of the same species fly in. It has recently been shown[8] that bats in flight emit

* Chemists handling products sold to the public must be sure that their senses for color, taste, odor, and touch are 'normal'; that is, that they correspond to those of the average person.

sounds too shrill to be heard by the human ear but audible by bats, which even in pitch darkness are enabled to avoid objects (*e.g.*, the walls of caves) by sensing the reflected supersonic waves—an aural radar, so to speak.

Granting that we have come to an agreement as to the result of an observation, we have not reached an end but merely a new position from which to begin another advance. As Tennyson phrased it:

> Yet all experience is an arch wherethro'
> Gleams that untravell'd world, whose margin fades
> For ever and for ever as I move.

Why is it that persons differ in their ability to taste phenylthiocarbamid? By what mechanism do extremely minute amounts of odoriferous substances enable cats and dogs, insects and wild animals, to draw such swift and certain conclusions? Is the so-called 'sixth sense,' commonly found in the blind and sometimes in the seeing, based on an unusually well developed sense of hearing, coupled perhaps with an extremely sensitive epicritic sense? Mice and bats ('flying mice') hear what to us is supersonic, and fish are believed to 'feel' the presence of rocks by virtue of eddies or reflected waves of compression, not quite the same as 'sound waves' in the water.

But it is not always easy to secure an agreement as to the 'facts,' especially if there is no obvious way of explaining a phenomenon on the basis of proven existing knowledge. A case in point is that of dowsers, who practice the art of locating underground streams of water. One branch of the divining-rod (a forked twig, usually of hazel) is held in the right fist with the clenched fingers up, the other branch being held in like manner in the left fist, with the forked center of the rod vertical. The dowser slowly walks across the area under investigation, and the fork is supposed to turn sharply downward when he passes over running water. Watching a successful dowser at work, I observed, as have others, that the downward turning of the fork is consequent upon a slight inward rotation of the clenched fists; and I found that this effect can be repeated voluntarily. When I traversed the same area as the dowser, the rod dipped in the same places as with him, and for the same reason—my wrists spontaneously turned inward. As a check, I had about ten persons, unacquainted with the dowser's findings, make the same experiment. Most of them got the same response as the dowser, with the same inward twist of the wrist.

On the other hand, dowsers tested in a laboratory with concealed pipes through which water could be made to flow at will, failed to locate flowing water; and many writers of repute consider the effect a conscious one, the dowser being a 'good guesser,' who depends upon observing types of vegetation, the lay of the land, etc. I am tempted to refer to this rather dangerous mooted question first, because it shows to what a remote level of material structure one may be forced to go in *an attempt* to explain a phenomenon, but especially because so eminent a scientist as Sir J. J. Thomson, Master of Trinity College, Cambridge, in discussing water-dowsing states: [9]

"There are some who can detect water without using the rod, since they experience peculiar sensations when they are in places where the rod would move. The rod may be a convenient indicator of a physiological effect. There is no doubt of the reality of the dowsing effect. In fact, in many agricultural districts the dowser is the man they call in when they want to find the right place to dig a well, and he

very often succeeds. We had an example of this at Trinity College. The water supply to one of our farms was very defective and a new well was badly wanted. At first the Senior Bursar, who was a Fellow of the Royal Society, proceeded in the orthodox way and employed eminent geologists to report on where we ought to sink a well. Their advice, however, did not lead to the discovery of any water. Our land agent said, "If I were you, I would try old X, who has found a good many wells in this county and who will sink the well on the terms 'no water, no pay.' " As there seemed nothing else to be done, the Bursar employed him and he found water. For this we were assailed in an article in Nature, which lamented that Trinity College—the College of Newton—should have given countenance to such superstitions and unscientific practices.

'Although I think that most of the people who have paid any attention to the subject believe in the reality of dowsing, there is no agreement about its cause. . . . In some cases the movement of the rod occurs when the dowser has been blindfolded, or when he has not been near the part of the country before.'

Thomson points out that all of the many English well waters he had examined contained radioactive emanation from radium which has a life of only four days, so that stagnant water would soon lose its radioactivity, and if this were connected with the effect on the dowser, it would explain why he can detect only *running* water.

Almost a century ago Quincke observed [10] that when water is forced by pressure through a porous membrane or a single capillary, a potential difference is set up between the opposite sides of the membrane or the opposite ends of the capillary. This is known as 'streaming potential.' But I know of no evidence connecting the reactions of a dowser with any kind of electrical or other radiation, although something might be shown by refined apparatus similar to that used by Sir Edgar D. Adrian and his collaborators to measure the tiny and evanescent electrical impulses in single nerve fibrils,[11] and Loomis and Harvey [12] to record the Berger and other electrical rhythms of the brain. Thomson concludes:

'The divining-rod is perhaps, of all phenomena which may be thought to be psychical, the one most favorable for experiment. The motion of the rod is a mechanical effect and gives an indication of the magnitude of the phenomenon. The conditions under which the effect occurs can be made definite, and there is no lack of trustworthy people who possess the dowsing power: for these reasons I think such experiments are well worth making.'*

Most people do not think of 'static' unless it affects radio reception; yet many fires and explosions† have been due to sparks developed upon the release of static charges arising from the friction of belts on pulleys, or of rubber tires on roads. Gasoline trucks have chains dangling in electrical contact with the earth, and at toll gates there are erect and grounded wires to carry off static charges

* 'Since the above was written I have seen a paper by Mr. H. M. Budgett, published by the British Society of Dowsers, on the connection between effects on a divining-rod and the readings of an instrument designed to detect very penetrating radiation. There seemed to be indications of some connection, but these were very faint. It would be interesting to see if the dowser could, by his divining, detect a strong beam of penetrating γ-rays.' (Thomson).

† A press dispatch dated Nov. 10th, 1942, stated: 'An explosion of anesthetic gas, reportedly caused by a static spark, killed a patient to-day as he was receiving a blood transfusion after a chest operation. . . .'

which otherwise might give a sharp shock to both chauffeur and toll-taker. Modern printing presses have combs and other devices to 'bleed off' frictional charges which would make the paper sheets unmanageable.

It might seem a far cry from sun spots to textile mill troubles; but a direct connection is claimed to be consequent upon electromagnetic disturbances set up by the spots in the earth's atmosphere,[12a] for these accentuate conditions which usually do not seriously disturb textile operations. One mill had to close down some of its processes at times during a sun spot period, because excess static would not allow the fibers to draft properly. Trouble was widespread, and both machinery and fiber quality were blamed, although no change had been made in either. Static seems to be an important 'imponderable,' and it is not unlikely that atmospheric conditions suitable for textile operations depend largely upon the presence of sufficient ionization and moisture in the air to prevent troublesome accumulations of static. Under suitable atmospheric conditions combing the hair makes it 'fly' or 'bristle.'

Tiny quantities of electricity may initiate extensive effects. Thus in the course of an informal discussion, Dr. Willis R. Whitney estimated that the energy utilized by a fly in crawling up one inch against the force of gravity (one 'fly-inch' power), could, if released in Los Angeles, activate a radio aerial in New York for over thirty years. And even though Hamlet correctly observed that there are more things in heaven and earth than are dreamed of in our philosophy, when we try to explain a phenomenon we must not overlook principles of common knowledge, no matter to what structural level we may have to go.

The Application of Mathematics to Physical and Chemical Problems

The data obtained by experiment and observation are often subjected to what is termed rigid or rigorous mathematical analysis in order to develop the nature of the relations between individual observations and to deduce logical corollaries therefrom. A consideration of some of the principles underlying this highly valuable application of mathematics reveals certain pitfalls yawning for the unwary scientist who steps over into mathematics, as well as for the mathematician who deals with scientific data.

Pure mathematics deals with real and imaginary quantities and their relations, and is based on abstractions drawn from practical experience. Thus we know that two plus two make four, because if we have four apples and eat or give away two, we have two left. Certain primitive savages cannot count beyond one, so that when they trade sheep for knives, they place one knife with each sheep. The decimal system seems to have had its prehistoric origin in the fact that tally can be kept by the fingers. Esquimaux describe *fifteen* as 'two hands and one foot,' and in keeping count it is common practice to make four vertical strokes with a cross-stroke 'tally' for five.

Pure mathematics has undergone great development, but has maintained its basic principle of dealing logically with abstractions which may or may not correspond to physical realities. Consider $\sqrt{-1}$, often used in electrical calculations. Untrammelled by material facts, a mathematician may romance like a novelist, providing only that he adheres to the logical use of assumed premises. And though life is often stranger than fiction, the mathematician Sylvester has said that a mathematician is never so happy as

when he does not know what he is talking about.

Applied mathematics, on the other hand, concerns itself with physical units and their behavior, and utilizes the logical, impersonal theorems of pure mathematics to express and develop qualitative and quantitative relations between these units and their behavior. Despite the great differences in philosophical and metaphysical theories and beliefs, and the admission that we cannot even conceive what are the ultimate units of matter, every person in his daily life shows by his actions that he believes matter to be *real*.[13] The units of the applied mathematician may be electrons flying about atomic nuclei, or the levers of a machine, or the planets of the solar system; but whatever they are, the physicist and chemist are compelled to discover, by experiment and observation, certain facts and relations regarding them. It is usual to combine and reason mathematically with these findings, after expressing them in a condensed mathematical form, or *formula*. The word 'formula' is a diminutive of the Latin *forma* (form), and therefore means simply 'a little or concise form.' The pure mathematician may assume facts to form a convenient equation, subject to mathematical manipulation. The applied mathematician, who is often a physicist or a chemist, must find equations to fit the facts, always remembering that equations are mute and make no protests against sins of commission or omission. St. Paul warned that we cannot be all things to all men; but a truly valid equation must be all things to all pertinent facts, known and unknown.

The history of science is full of instances where accepted notions have been discarded or modified because of new knowledge. Even in the days when diet was based on 'fat, carbohydrate, protein, and total calories,' any grandmother knew that codliver oil had a potency far greater than olive oil, its quondam theoretical dietary equivalent. The discovery of the importance of trace substances in the diet, including vitamins, iodine, copper, etc., and recognition of the fact that most proteins do not contain all of the amino acids essential to well-being, have led to a marked revision in feeding both humans and animals. Long before any scientific explanation was available for the use of protective colloids in modifying cows' milk for infant feeding, practical physicians had recommended and utilized the addition of gelatin, gum arabic, dextrinized starch and the like, and in folk practice such colloids as Irish moss, Iceland moss, and Bavarian beer (of high dextrin content) were used.[14]

Certain elements exist in allotropic forms that owe their differences to the way in which their constituent atoms are assembled. This raises the question as to the minimum number of atoms which must get together in a certain configuration to make the smallest conceivable particulate unit of a certain allotrope. Thus a single carbon atom can not be graphite or diamond. Theoretically, the smallest unit we could call graphite must have at least twelve carbon atoms, arranged in two hexagonal layers 3.40 A apart, while in diamond we can imagine a minimum unit of five carbon atoms, four being arranged in the form of a regular tetrahedron whose side is 1.54 A, with the fifth carbon atom centered within. Particles handled experimentally are usually very much larger than these suppositious minimum units, but rings of six carbon atoms have been demonstrated in the mass spectrograph. By electron diffraction methods Germer and White estimate that the smallest crystals formed by vaporizing copper on supporting foils of iron or of Invar

gave ring intensities between those calculated for crystals of 55 and of 397 atoms each.[15]

In J. W. Mellor's monumental book,* Vol. V, p. 720 (1924), it is stated: 'Boart and carbonado are usually regarded as forms intermediate between diamond and graphite.' The following descriptions are condensed from the catalog of a large dealer in industrial diamonds: *Boarts* (borts) are more or less transparent crystals of most varied shapes, sometimes twin and multiple formations. *Carbons* (carbonado), often called amorphous diamonds, differ essentially from boarts in structure; they are a porous cluster of minute diamond crystals, fine to close-grained. The fracture of a good carbon should resemble the structure of fine steel. Much harder than boarts, and much less fragile, they can be used until entirely consumed. *Ballas* † are roundish aggregations of innumerable minute crystals grouped concentrically about a nucleus. Being non-porous and devoid of cleavage planes, they are about as hard as good carbons, but tougher because of their structure. Brazilian ballas is used to test the hardness of carbons. When the two are rubbed together, a white mark indicates that the carbon is harder, while a dark brown mark indicates that the ballas is harder. If both stones are of equal hardness, *no* mark results on either.

Early in 1928 I secured specimens of ballas, and of a fine and poor grade of carbonado, and Professor George L. Clark kindly took x-ray spectograms of them all. The results indicate that the ballas was composed of a great number of small diamond crystals, the poorer carbonado of still smaller and more numerous crystals, while the fine carbonado had still finer crystals, many being of colloidal dimensions so that the rings of its x-ray spectogram were continuous. No other form of aggregation than that of diamond was apparent.[16]

Currently Recognized Structural Units and Levels

It is not so long ago that students were taught that atoms represent the lower limit of material structure: curious sphere-like bodies, all alike for each element, having potent but inscrutible idiosyncrasies or 'affinities.' Prout's hypothesis (1815) that all elements are built up from some single basic unit ('protyle' or hydrogen) was considered as having been completely disproved by the meticulous atomic weight determinations of Stas. We now know that only in relatively few of the elements (*e.g.*, He, Na, P, V, Mn, Co, As, I, Au, Bi, among the commoner ones) are the atoms all alike, for most elements have a variety of *isotopes*—atoms closely alike in chemical behavior

* Mellor quotes Lucretius (60 B.C.): 'It matters much with what others, and in what positions, the same atoms are held together. . . . When the configuration of the atoms is changed, the properties of the body which is formed from them must also change.' H. A. Miers (article on 'Diamond' in 'Encyclopedia Britannica,' 11th ed., 1910) stated: 'Both bort and carbonado seem to be really aggregates of crystallized diamond, but the carbonado is so nearly structureless that it was till recently regarded as an amorphous modification of carbon.'

† The word 'ballas' appears to be a modified form of the Portuguese word *balas*, meaning *bullets*. The Spanish and Portuguese word *bola* means *ball*, whence is derived the Argentine *bolas*, the throwing-rope having ends weighted with heavy balls. . . . Through the Latin *ballista*, the word goes back to the Greek βαλλειν, meaning to *throw*. *Palla* is an old German form, and the golden balls of the house of Medici, now used by pawnbrokers, were known as *pallé*, which was the rallying cry of the Medici retainers.

but different in mass. Thus chlorine is a mixture of about 76 per cent of an isotope of mass 35, with 24 per cent of an isotope of mass 37; tin has ten isotopes varying in mass from 112 to 124, and lead seven with masses from 203 to 210. The careful atomic weight determinations of T. W. Richards and others have shown differences in the atomic weight of lead from several sources. Furthermore, though the structure of atoms is not as simple as Prout had assumed, the basic work of Lord Rutherford and many others has shown that all the diverse elemental atoms are built up of a few units which we are at present unable to resolve further.

Starting with these basic units as our present null point, there is given below a triplex table which aims to illustrate the currently recognized structural levels or orders of material complexity commonly found in nature. On the left appear the basic material units and unit structures generally recognized by physicists and chemists. In the middle, at corresponding levels, appear the units recognized by biologists, geneticists, and medical men; and on the right, units demonstrable in cotton textiles, in starch, and in steel. As we rise to the larger and larger aggregates, the definiteness and strength of the forces holding together their proximate sub-units diminishes, and the boundaries between structure levels become less definite.[17]

The table demonstrates *the great importance of structure,* for from comparatively simple chemical elements and molecules, diverse and complicated structures develop, whose properties are greatly influenced by the manner in which their subunits are assembled and held together.[18] It is impossible to do more than to suggest in the table the importance of secondary substances which, when present in sizable amounts or even in traces or as 'impurities,' may exercise an influence upon structure and function quite unexpected and out of proportion to the amount present.

Mixtures vs. Pure Substances

Mixtures often show curious properties. Thus 'half and half' solder melts at 220° C, which is far below the melting points of its constituents, tin (m.p. 232° C.) and lead (m.p. 327° C). The influence of colloids upon crystallization, long ago recognized,[19] is of great biological and technical importance. The quantity needed to produce a marked effect may be very small. Thus .01 per cent gelatin greatly retards the setting of plaster of Paris and prevents the formation of the ordinary visible crystals. Minute quantities of protective colloids may cause precipitates to fall out in the colloidal state, and small amounts of 'addition compounds' greatly affect the electro-deposition of metals.[20]

H. G. Bungenberg de Jong and H. R. Kruyt[22] found that when the dispersed substance in hydrophilic sols is thrown out by a variety of methods, *e.g.,* salts in large or in small amounts, removal of solubilizing salts, temperature change, addition of an oppositely charged sol, the 'precipitate' often forms viscous droplets which aggregate into a fluid mass called a *coacervate,* instead of forming a solid phase. The phenomenon, termed *coacervation,* had been observed by F. W. Tiebackx,[23] who commented on the resemblance to casein of the gelatin-gum arabic coagula. Strongly adsorbed shells of water are supposed to surround the droplets and act as a protective film along the lines suggested by Zsigmondy for the protective action of water ('Colloids and the Ultramicroscope,' Chapter 18, transla-

Successive Levels of Material Structure

Elementary Particles (at present 1943 recognized)

Order of Complexity 0	Charge	Size (Å)	Mass (gram)	Discoverer	Where Found
Electron	−e	3×10^{-5}	9×10^{-28}	Sir J. J. Thomson (G. Johnstone Stoney) (Sir Wm. Crookes)	Electric current Negative electrostatic charges Nuclear satellites and emissions
Positron	+e	3×10^{-5}	9×10^{-28}	C. D. Anderson	Emitted by atomic nuclei
Neutrino	0	2×10^{-5}		E. Fermi, W. Pauli	Existence inferred from general theory
Proton	+e	2×10^{-5}	1.66×10^{-24}	Sir Ernest Rutherford	Nucleus of protium (H)
Neutron	0	2×10^{-5}		James Chadwick	Atomic nuclei
Positive Mesotron	+e	2×10^{-5}	2×10^{-25}	C. D. Anderson and Seth Neddermeyer	Cosmic radiation
Negative Mesotron ...	−e	2×10^{-5}	2×10^{-25}	C. D. Anderson and Seth Neddermeyer	Cosmic radiation

Material Structures	Order of Complexity	Mode of Examination	Approx. Size	Chemical Units	Biological Units	Cotton	Starch	Carbon Steel
				Biology and Medicine		*Technology*		
Atomic Nuclei	1	Transmutation Cyclotron	H = 2×10^{-6} Å Au = 1×10^{-4} Å					
Atoms	2	Cyclotron X-Ray Chemical	5 ± Å	C, H, O, N, P, S, Fe, K, Na, Ca, Mg, Cl, Fl, B, I, Zn, Cu, Cr, Ni, V		C, H, O	C, H, O	Fe, C. (0.1 — 1.0% (S, P, Si, Mn, etc.) 0.5% C = ca 7.5% FeC_4
Molecules	3	Infrared and Raman Spectra, X-Ray, Chemical	50 Å±	Amino-acids, Lipoids, Nucleotides, Glucose etc.	Vitamins, Hormones, Thiamin Pyrophosphate Carriers† etc.	Glucose, etc.	Glucose	Fe, C, FeC_4
Macromolecules* ... Molecular Aggregates	4	Electron Microscope Ultramicroscope Chemical	100 mμ±	Proteins, Glycogen, Cellulose, Starch, etc.	Enzymes, Chlorophyll, Cytochrome, Bacterio-phages, Genes, Viruses, etc.	Molecular Chains and Groups	Molecular Chains and Groups	α-iron (Ferrite) γ-iron Cementite
Micells	5	Electron Microscope Ultramicroscope	1 μ±		Cytoplasmic structures	Aggregates with impurities		
Microscopically Resolvable Units ...	6	Chemical Microscope	¼ μ±		Chromosomes, Nuclei Cells	Fibrils	Starch grains	Austenite (α-iron) Martensite (γ-iron) Troostite Sorbite Pearlite
Visually Resolvable Units	7	Eye	50 μ±		Tissues, Organs, Bacteria, Drosophila, Mouse, Whale	Fibers, Yarns, Fabrics, Clothing		Hair-spring, Saw, Engine, Bridge Sky-scraper

* Primary—Colloidal Particles ..... 30 mμ±
Secondary—Colloidal Particles ..... 100 mμ±

† Moleculobiont, hypothetical simplest living unit.

tion by J. Alexander, New York, 1909). In the case of many coacervates it seems likely that some impurity, or some fraction of one of the ingredients, may separate at the droplet interface and serve as a colloidal protector. It is well known that very pure materials, *e.g.*, iron, vanadium, may have properties quite different from even ordinary C.P. substances.

The effect of a product in a mixture varies with the specific natures of the substances mixed, or formed on mixing. Thus practical cooks use butter, hydrogenated oil, lard, etc., to make cakes and cookies 'tender,' and similar 'shortening' materials are added to make pie crust 'flaky.' Such additions weaken the cohesiveness of the final product. On the other hand, technologists in various fields use small amounts of colloidal material to make the final product stronger; *e.g.*, rosin size in paper; starch size in warp yarns; thin layers of adhesives in building up cardboard and wood veneers. It often happens that thin layers of secondary materials become absorbed at micellar surfaces, and act as *cohesive colloids*, binding the micellar or other small units into coherent structures.[21] This may be the case with starches, where the binder, 'amylopectin,' appears to have the same ultimate chemical analysis as 'amylose.' About twenty years ago Sponsler[22] showed that grinding destroys the x-ray pattern of starch which is due to some symmetry of structure in the granules; and recently Lampitt, Fuller and Goldenberg[23] ground starch for as long as 7,000 hours in a ball mill and concluded that grinding breaks the weaker lateral linkages without any significant breakdown in the 'repeating units,' identified by Brawn, Hirst and Young[24] as consisting of from 24 to 30 anhydro-β-glucose units. Glycogen ('animal starch') appears in similar 'chains' composed of either 12 or 18 glucose units.[25] Farr[26] believes that ellipsoidal units of cellulose are cemented into fibrils by a cohesive substance which contains some pectin. Recently, Zweifach[27] stated that cells in the capillary wall are bound together by a calcium protein compound, and that diffusion takes place through this intracellular cement rather than through the cells themselves.

The Importance of Impurities

Although the importance of 'impurities' has long been stressed, the mistaken popular notion still persists that an ordinary 'chemical analysis' (usually presented in the form of atomic percentages) will tell all one needs to know about a manufactured or a natural product. The consulting chemist usually has to bring home the importance and delicacy of structure by pointing out, for example, that although dropping a watch on the floor may not change its chemical composition, the shock may ruin its value as a timepiece. Scientifically, recognition of the importance of structure has been a matter of gradual growth, mainly because scientists are prone to magnify and reason with the factors they can understand and explain, and fail to suspect that 'rigorously exact' or 'strictly quantitative' measurements may be vitiated, as von Weimarn emphasized,[28] by variations in structure and by the existence of unknown factors.

In plant and animal nutrition, nowadays, we hear much of secondary substances (*e.g.*, 'roughage'), of impurities (*e.g.*, the average hen's egg contains about a milligram of zinc), and of trace substances essential to growth and life (*e.g.*, vitamins, copper, iodine, boron, etc.). Dr. R. A. Steinberg (U. S. Dept. of Agriculture, 1939) reported that a common mould needs traces of gallium to grow and reproduce—10 to 30 parts per

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billion of water are necessary, and no other element appears to serve as a substitute. In cases where such minute quantities are so potent, the presumption arises that the trace element enters into the formation of a catalyst.[29] Robinson, Whetstone and Scribner[30] investigated the abnormal behavior of alumina from leaves of a hickory tree growing in a Virginia pegamite vein, found that at least 0.2 per cent of the dry weight of the leaves consisted of rare-earth oxides, mainly of cerium, lanthanum, praseodymium, neodymium, yttrium, samarium, and europium. Sir F. G. Banting[31] in speaking of the purification of insulin, said: 'With the elimination of impurities the insulin was more rapidly absorbed and the duration of its effect was lessened. . . . Hagedorn (of Denmark) and his colleagues, 1933-35, found that the addition of protamine to their insulin so delayed the action that the day's supply of insulin could be given in one injection. This was the greatest advance in the treatment of diabetes since the discovery of insulin. Scott (of Toronto) found that when protamine was added to zinc-free amorphorus insulin, there was little or no delay in the rate of absorption. If, however, zinc was added, a combination occurred between the insulin and protamine with the characteristic slowing effect of the protamine. It would seem that the Danish insulin contained sufficient zinc or other specific metal to produce this combination.' The effects of zinc-insulin (without protamine) seem to be intermediate between those of pure insulin and zinc-protamine-insulin.

In attempting to envisage the mechanism underlying a phenomenon, it is necessary to focus attention initially upon the structural level where the crucial factors are operative. Thus with radioactivity we consider the nuclear level; with chemical problems, the atomic and molecular levels. Structures of the most diverse chemical nature (iron, wood) may function as chairs, though tests may be devised to bring out the chemical differences. As a rule changes at lower levels exert potent influences at higher levels, and vice versa. Apparently conflicting observations may often be resolved when structural interrelations are properly appreciated and appraised.

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CHARLES S. PEIRCE, *Chance, Love and Logic*

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LINGUISTICS AND THE FUTURE:

Some Implications of General Semantics[1]

S. I. HAYAKAWA

I

'IT IS EVIDENT,' wrote Hume in his introduction to *A Treatise of Human Nature,* 'that all the sciences have a relation, greater or less, to human nature; and that, however wide any of them may seem to run from it, they still return back by one passage or another. Even Mathematics, Natural Philosophy, and Natural Religion, are in some measure dependent upon the science of man; since they lie under the cognizance of men, and are judged of by their powers and faculties. . . . Here, then, is the only expedient, from which we can hope for success in our philosophical researches: to leave the tedious lingering method which we have hitherto followed, and, instead of taking now and then a castle or village on the frontier, to march directly to the capital or center of these sciences—to human nature itself—which, being once masters of, we may everywhere else hope for an easy victory. . . . There is no question of importance whose decision is not comprised in the science of man; and there is none which can be decided with any certainty, before we become acquainted with that science. In pretending, therefore, to explain the principles of human nature, we in effect propose a complete system of the sciences, built on a foundation almost entirely new, and the only one upon which they can stand with any security.'

These are Hume's words, but they might almost serve today as both an introduction and a motto for the work now being attempted in general semantics. For what the semanticist is trying to do is Hume's task over again, namely, that of formulating the science of sciences. Such a task has become, of course, increasingly formidable since Hume's day; nevertheless, with the progressive specializing and atomizing of knowledge, the need for such integration has become progressively more acute.

But to help us in such a task, we have two resources not available to Hume: first, we have a vast amount of new scientific knowledge, including such fundamental advances as the electrodynamic theory of matter, the non-Euclidean geometries, the relativity theory of Einstein, quantum mechanics, the chemistry of colloids, all of these completely overturning age-old categories and habits of speech; secondly, we have dramatic confirmation of the implications of the new sciences in our linguistic researches, which have established the fact that many of our so-called

[1] Reprinted, by permission of Columbia University Press, from *American Speech,* Vol. XVIII (October, 1943). The article was entitled in *American Speech* 'Science and Sanity.'

'laws of thought' are merely laws of the structure of the Indo-European languages.[2] In such findings of science, Korzybski claims, we have the foundations of a new epoch in human history. The first stage of human development, from his point of view, is that of the savage, prelogical mentality, with a one-valued semantics (or system of evaluations), in which, as Lucien Lévy-Bruhl has said, 'everything is everything else' by 'mystic participation.'[3] The second stage is that on which European civilization has been based. There are sharp categories: 'This is this; that is that; this is not that'; the semantics are two-valued: a thing is either *A* or *not-A;* the use of powerful abstractions, such as 'space,' 'time,' 'matter,' 'causality,' appears with the development of vastly increased cerebral activity. This stage Korzybski calls 'aristotelian.' We are, however, on the threshold, he says, of a third stage: the 'non-aristotelian,' non-Euclidean, non-Newtonian stage. The complete revolution Einstein has produced in physics is only part of a general revolution that must eventually affect all human knowledge.[4]

In *Science and Sanity,* Korzybski offers us what he hopes is the handbook of this revolution. His system, which he calls 'general semantics,' is ambitious in content, far-reaching in its implications, yet its recommendations appear simple and practical. It involves at once a psychology, a unification of science, an educational method, and an ethics. As psychology, the distinctive feature of general semantics is that it regards the symbolic process as the basic differentiation between animal and human behavior. In accounting for human behavior it postulates the 'neuro-semantic environment'—the environment, that is, of dogmas, beliefs, creeds, knowledge, and superstitions to which we react as the result of our training—as a fundamental and inescapable part of our total environment. Mechanistic psychologies, as every humanist has complained, have, by ignoring or passing lightly over man's symbolic behavior, made overfacile analogies between men and animals, with the result that such behavior as is distinctively human was either neglected or crudely oversimplified. General semantics, as a psychology (or 'psycho-logics,' as Korzybski prefers to call it), by making man's symbolic processes and functioning the central object of study, claims to put the Prince of Denmark back into *Hamlet.*

II

As unification of science, general semantics explores such widely scattered fields as the comparative neurology of animals and human beings, the behavior of children and savages, the behavior of mathematicians and scientists in the manipulation of their symbols, and the behavior of the mentally ill, and seeks to evolve from such explorations general laws regarding the assumptions that underlie sane, adult, productive orientations and those that underlie un-sane, infantile, self-destructive orientations. The aristotelian orientations, Korzybski claims, based upon ancient epistemologies and antiquated theories of nature, inevitably lead under present conditions to 'blockages.' These blockages manifest themselves in personal life as fixations, complexes, and neuroses; in public discussion, debate, and

[2] See, for example, Benjamin Lee Whorf, 'The Relation of Habitual Thought and Behavior to Language,' in *Language, Culture, and Personality: Essays in Memory of Edward Sapir* (Menasha, Wisconsin: 1941).

[3] Lucien Lévy-Bruhl, *How Natives Think* (New York: Alfred A. Knopf, Inc., 1926).

[4] See also Oliver L. Reiser, *The Promise of Scientific Humanism* (New York: Oskar Piest, 1940).

even in scientific discourse as the objectification of abstract entities, which results in inquiry being halted, sometimes for decades, sometimes for centuries, while men struggle over non-sense questions. The new orientation is based on the discarding of 'elementalism,' or the verbal splitting of that which cannot be empirically separated: space *and* time, body *and* mind, intellect *and* emotion, etc. In discarding this 'elementalism,' we discard that now almost inevitable tendency constantly to treat parts as if they were independent of the whole, and to treat the whole as if it were the sum of its parts. The 'law of identity' (*A* is *A*) is also discarded as empirically false-to-fact. An 'infinite-valued orientation,' based on the 'logic of probability,' is substituted for the 'two-valued orientation,' based upon the 'logic' of Aristotle. These and other formulations, which revise the basic assumptions underlying our language, Korzybski regards as the principles upon which the most advanced researches of modern science are based. Training in general semantics, he claims, will make possible the application of our newer scientific attitudes to problems hitherto found extremely difficult or insoluble. Such application will free the still struggling social, political, and ethical sciences from the shackles provided for them by our primitive linguistic heritage.

As an educational theory and method of mental hygiene, general semantics uses the non-aristotelian principles as a theory of sanity, to be applied to check and correct the evaluations we make in everyday life. By destroying the delusional worlds that all of us, in some respects at least, inhabit as the result of our evaluational habits, we clear the way, Korzybski says, for new knowledge and new orientations. Despair, disillusionment, doubt, and frustration are, in most cases, the result of misevaluations, which in turn disclose our improper responses to symbols or symbol-situations. These improper responses Korzybski calls 'signal reactions'—that is, invariability of response such as we would have if a chimpanzee were taught to drive a car; it would step on the gas at a green light, even if another car were in its path. Similar invariabilities of reaction, both to linguistic and non-linguistic stimuli, he finds, are at the bottom of countless personal confusions as well as 'philosophical' dilemmas. As long as all of us are in some respects trained in animalistic response-systems, we cannot, Korzybski says, drive in the complicated traffic-stream of modern life without producing the kind of murderous traffic jam we now have.

General semantics, formulated as a system of retraining, is offered as a means of recanalizing those responses (both to linguistic and non-linguistic stimuli) that cause morbid over-excitations of the nervous system: retraining in such a way as to bring automatically into play the higher centers of the brain. The healthy human reactions he terms 'symbol reactions.' Education in symbol reactions, whether applied to a patient in a consultant's office, to students in a classroom, or by an individual to himself, is bound, Korzybski claims, to have beneficial results, since it breaks those vicious circles, great or trivial, that drain our energies and arrest our development.

Finally, as ethics, general semantics bases itself on the fundamental characteristic of man by virtue of which he is human, namely, his ability to accumulate knowledge and experience from generation to generation, so that each individual lives his life dependent on the products of the nervous functioning of other individuals, most of them unknown to him and long since dead. This human characteristic, so familiar that we rarely even think about it,

yet so obviously the central fact of our humanity, Korzybski terms our 'time-binding' capacity. In the act of naming man the 'time-binder,' he at once gives a functional, non-elementalistic description of man, and prescribes his ethics. Moral behavior, as far as Korzybski is concerned, is that which promotes time-binding: that which preserves the knowledge and wisdom of the past, tends to bring human beings into agreement for the co-operative solution of their problems, and adds to human knowledge for the benefit of future generations. But time-binding is accomplished through the use of symbols. Without the recognition of time-binding as the central fact underlying human accomplishment, we have paid too little attention, he says, to the symbolic process, and we have uncritically permitted its abuses and misuses to flourish. We have been defining man in non-functional and elementalistic terms, either as an animal of somewhat superior kind, or as a fallen angel, with the result that we have unconsciously alternated between two absurdities, on the one hand imitating animals (usually the predatory ones), and, on the other hand, trying intermittently to behave like angels. With the recognition of time-binding, however, as the essential characteristic of human life, the study of the proper and improper, the sane and the unhealthy operation of the symbolic process—the study, that is, both of the normal functioning and the pathology of our neuro-linguistic, neuro-semantic reactions —provides the basis for an ethics that is at once demonstrable and practical.

III

This is neither the time nor the place to evaluate all the other work being done in semantics at the present time: by I. A. Richards and his followers in literary criticism, by P. W. Bridgman and Bertrand Russell, by Rudolf Carnap and C. W. Morris and the 'Unity of Science' group, by Jerome Frank, Thurman Arnold, and E. S. Robinson in law, and by many others in many other fields, except to say that all have made extremely valuable contributions, and that no one interested in the subject can afford to leave any of them unread. Korzybski's 'non-aristotelian system,' however, appears to be at once the most inclusive and the most usable of the syntheses yet produced. However difficult the demonstrations and proofs of the system to be found in *Science and Sanity*, the principles to which general semantics can be boiled down are simple, and can readily be taught to students or applied to one's own work. According to reports now being accumulated both by Korzybski and his co-workers, the effects of such retraining and application appear to be beneficial wherever tried: in psychiatry, as Dr. C. B. Congdon of the University of Chicago, Dr. D. G. Campbell of the University of California, and Dr. Hervey Cleckley of the University of Georgia have reported; in speech correction, as Dr. Wendell Johnson of the University of Iowa and Dr. Spencer F. Brown of the University of Minnesota have reported; in the study of reading difficulties in elementary and secondary education; in the teaching of the sciences, in mental hygiene, and in many other fields, including, as I am able to report from my own experience, the teaching of English. Furthermore, mathematicians, psychiatrists, biologists, jurists, sociologists, philosophers, and artists have been provoked by Korzybski and the questions he has raised into new and exciting speculations.

In the face of this vast increase of interest on all sides in matters of language, students of linguistics are in a peculiarly favored position. Many of the commonplaces of linguistic science are also corner-

stones of semantic thought. Linguistic students have long been familiar with the principle that no word ever has exactly the same meaning twice: that when by 'meaning' we refer to the relationship of an utterance to its total context, there is no such thing as identity. Comparative linguistics has offered us insights not often available to laymen into what is meant by 'the structure of language.' Phoneticians have familiarized us with the notion of the absolute uniqueness of events, as well as with the process by which the human nervous system unconsciously abstracts significant features from unique *continua* of noises.[5] In dealing with such terms as 'word,' 'sentence,' 'dialect,' 'the English language,' 'speech defect,' etc., we are constantly struggling against the objectification of fictional entities.[6] In the problem of defining the phoneme, we have been familiarized with the character of the abstractional fiction, and through such familiarity we have been inducted into crucial questions of scientific method.[7] Mentalistic 'causes' to which linguistic events have been attributed have been all but abolished by the rigorous empiricism of modern investigators of language.[8] Students of the psychology of language, dialect geographers, students of speech pathology, have all been advancing the principle, in one direction or another, that the study of linguistic phenomena must take into consideration the totality of their non-linguistic contexts. In short, scientific students of language already have, toward the subject-matter which they investigate, that awareness of terminological pitfalls, that flexibility of evaluation, and that non-elementalism which general semantics regards as essential.

The student of language who studies general semantics will find himself convinced, I am sure, of two things, whatever may be the objections, corrections, or emendations he may wish to offer to the system. First, he will feel convinced that the study of language is a far more important subject than even he has ever ventured to claim. None of us, after all, would deny that symbolic behavior is central to all that we term human activity. Nor would we deny that patterns of behavior are determined to no inconsiderable degree by the language we happen to inherit.[9] Still less would we shrug off the whole matter by saying, 'If you improve people's thoughts, their language will take care of itself.' Secondly, the student of linguistics will find it difficult to escape the conclusion that *some* system of *general* semantics, with Korzybski or without, is necessary for the integration of our linguistic researches with other fields of human inquiry. Such conclusions will lead to profound reorientations in our work. Linguistics, purposefully redirected in such a way as to throw light on how man's linguistic machinery works and what it does, will tend to become less exclusively a study of the kinds of noises man makes,

[5] See, for example, G. O. Russell, *The Vowel*, 1928, and *Speech and Voice*, 1931.

[6] Leonard Bloomfield, *Language*, 1933. On 'speech defects,' see Wendell Johnson, *Language and Speech Hygiene*, 1939, chapter II.

[7] W. F. Twaddell, *On Defining the Phoneme*, Language Monograph, Linguistic Society of America, 1935.

[8] Bloomfield, *op. cit.*; see also *Linguistic Aspects of Science*, 1939.

[9] 'It is quite an illusion to imagine that one adjusts oneself to reality without the use of language and that language is merely an incidental means of solving specific problems of communication or reflection. The fact of the matter is that the "real world" is to a large extent unconsciously built upon the language habits of the group. . . . We see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation.' Edward Sapir, 'The Status of Linguistics as a Science,' *Language*, 5: 207-14, 1929.

and more a study of what those noises stand for and result in.

IV

Such a redirection of our studies ought, it appears to me, to be seriously considered. The investigation of the general laws governing the functioning and disorders of the symbolic process provides first of all a basis for the unification of disciplines in what are now apparently conflicting fields. For example, the teacher of English and the teacher of oratory and debate can find a common meeting ground in trying to inculcate in their students the habit of making meaningful statements, rather than glib or plausible statements. Furthermore, such investigations will provide a basis for the unification of graduate work in English, in which, as matters now stand, the student too often feels either that the study of linguistics is an unnecessary intrusion on his literary interests, or that literature is an intrusion on his linguistic interests. Again, general semantic studies will go a long way toward bridging the sometimes considerable gap that now exists between our interests as research workers in language or literature and the interests of our undergraduate students. There are few linguistic facts, drawn from whatever obscure source, which cannot, when fitted into a general system of semantics, be used to throw light on the problems of interpretation and of expression that confront, for example, our students in freshman English. When the relationship between our linguistic habits and our social, political and personal dilemmas is made clear, few students will be found to be so indifferent to their own fate in life as to ignore what we have to tell them.

Again, to the investigator of man's symbolic processes, literature, no less than science, becomes a doubly significant study. Semantics need not be, as some appear to believe, hostile to literature and poetry. On the contrary, it can find in the literary manipulation of symbols not only a wide range of special linguistic phenomena to be accounted for, but also a powerful means of affecting the reader's neuro-semantic reactions toward greater flexibility and greater sanity. From the point of view of the general semanticist, the problems of proper literary interpretation may be regarded as special cases of the larger problem of proper neuro-semantic evaluations. Training in literary criticism, therefore, can assume a far greater importance in general education than non-literary people have ever been willing to accord it. A general semantics should, consequently, in addition to awakening linguistic students to an increased sense of their importance and obligations, revitalize literary criticism.

I do not know if what Korzybski terms the 'non-aristotelian orientation' is what is needed to solve the bitter paradoxes of modern civilization: the starvation in the midst of plenty, and the international misunderstandings that grow bloodier and more destructive with each advance in our methods of communication. But the fact that humanity needs some kind of fundamental reorientation has never been as apparent as it is today. If Korzybski is right in maintaining that the correction of the disordered functioning of our symbolic process is a root problem in human affairs—and I believe he is—then we, as students both of language and of literature, have an important part to play in making possible the future emergence of a culture less barbarous than our own.

NEWTONIAN PHYSICS AND AVIATION CADETS

ANATOL RAPOPORT*

The Teaching of Physics

The following is an account of some difficulties I encountered while teaching elementary classical (newtonian) physics to aviation cadets at the beginning of the war. It is most likely that the same difficulties are encountered by very many teachers. Not very long ago an attitude prevailed among many educators and the public that most young people are 'naturally' hostile to mathematics and the exact sciences; that these disciplines are a 'necessary evil' like Latin, included in the curricula because they had always been included and therefore 'necessary' but of little or no 'practical value.' This attitude and the lack of understanding of the difficulties made it difficult to combat them.

At present there is an ever increasing realization that the knowledge of arithmetic, algebra, and elementary physics is indispensable to many people who participate in activities connected with our technology. What is not yet quite realized is that the educational value of the *process* of acquiring this elementary knowledge is even more valuable than the knowledge itself, because this process tends to shape mentalities able to utilize our technology most efficiently. This process, moreover, is a form of mental hygiene, beneficial for what Korzybski calls 'an efficient exploitation of our nervous systems.' It is to be noted that our nervous systems must also be considered as a part of our modern technology. At any rate, the aviation cadet must acquire this knowledge or be eliminated. Thus the difficulties which arise during the attempts to impart these very elementary disciplines to young men in their early twenties become very important.

An attempt will be made to analyze the difficulties and to show them to be mostly of verbal origin.

What 'Makes' It Fall

A great deal is said about the applications of new mathematics and physics (the theory of relativity, quantum mechanics, non-euclidean geometries). It is often remarked that these phases of the sciences are difficult to understand because they are 'contrary to experience' or 'detached from experience.' It is the purpose here to show that probably 'experience' has little to do with the ease or difficulty of understanding new formulations, except the experience in the use of words. This will be shown in the analysis of the strong resistance offered by the cadets in absorbing *newtonian* formulations, although it is generally said that newtonian physics, along with euclidean geometry and that part of algebra which does deal

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with imaginaries and hypercomplex quantities is *not* contrary to experience, but on the contrary is supposed to have resulted from deeply seated 'intuitions,' which, in turn, are rooted in experience.

The formulations of physics in the order of their presentation were the following: 1. The Second Law of Motion (Newton); 2. The Third Law of Motion (Newton); 3. Centripetal and Centrifugal Forces; 4. Bernoulli's Principle (Hydrodynamics); 5. Boyle's Law (Perfect Gas).

The resistance to these formulations became apparent in the answers to the questions in our quizzes and examinations. Invariably, after working a great many problems involving the equation

$$F = ma,$$

the cadets were asked the following questions on a quiz:

> When a parachutist reaches his terminal velocity in falling, he is moving toward the ground with constant speed. At that time:
>
> 1. the downward force acting on the parachutist is greater than the upward force;
> 2. the upward force is greater than the downward force;
> 3. both forces are of equal magnitude. (Multiple choice answer)

As I recall, about 75% of the cadets underlined the first choice, and the remainder answered the question correctly. When confronted with the correct answer, the immediate objection was usually: 'If the upward force equals the downward force, what makes the parachutist fall?'

The worst obstacle to overcome is the difficulty associated with the verb 'make.' What *makes* things fall? In other words what is the agency assumed to possess a 'will,' a 'power' to make things happen? The entire anthropomorphic attitude toward natural phenomena, remnant of ancient magic, is contained in this formulation of the question, 'What *makes* it so?' The very first inquiries of children into observed phenomena are so formulated as to inhibit correct thinking. Moreover, these inquiries are actively encouraged by well-meaning parents and teachers who rejoice at this evidence of alertness and curiosity, and do not realize that such formulation of questions may eventually do more harm than good by giving rise to prejudices difficult to overcome in later years.

Let us return to the example at hand and illustrate two types of reasoning. One of these is correct within the realm of the problem and leads to the correct answer; the other is incorrect and leads to a wrong answer.

It should be the effort of educators to encourage the following formulation and solution of this simple problem.

> GIVEN: a body moves with constant velocity v toward the earth and is acted upon by the force of gravity (downward) and the force of air resistance (upward).
>
> TO DETERMINE: The relative magnitude of two forces.
>
> SOLUTION: First determine the acceleration of the body. By definition, the acceleration $a = dv/dt$; hence $a = O$, since v is a constant by hypothesis. (In case differentiation is not known, an algebraic definition of average acceleration gives the same result). If F is the force acting on a body, (the body is here considered as a particle), m the mass, a the acceleration in the direction of the force, then by Newton's Second Law, $F = ma$. Since $a = O$, we have $F = m \times O = O$. But $F = F_1 - F_2$, where F_1 and F_2 are the respective magnitudes of the downward and upward forces acting on the body. Hence $F_1 - F_2 = O$; $F_1 = F_2$.

INTERPRETATION OF RESULT: The downward and upward forces are equal. Period.

There is no room for the question 'What makes it go?' Of course the same result could be derived by a shorter verbal argument based on Newton's First Law, but in my opinion verbal arguments should be avoided as much as possible. Sometimes they lead to disastrous results. They will lead to correct results if they are faithful translations into English of mathematics. But in most cases the language of mathematics is shorter and more elegant than the clumsy verbal translations.

Let us now see the steps in the 'reasoning' or rather in the chain of verbal reactions which go on in the minds of the young men who are *not* taught to mathematicise. Such 'reasoning' might well have been included in Aristotle's treatment of the subject.

> 'What makes bodies fall? Gravity. If it were not for gravity, bodies would not fall. There is an upward force acting on the body. This force resists gravity. If it were as strong as the force of gravity, it would cancel it. Body would not fall. Nevertheless body is falling. Therefore the resisting force is not strong enough to overcome gravity.'

That this is the actual chain of 'reasoning' in the minds of mathematically untrained people was brought out in discussion, and the author remembers very well when he indulged such 'reasoning' himself.

Notice the implications. Something *makes* bodies fall. There is close connection between this 'making' bodies fall or in general 'making' things happen and one's own sensations of 'willing,' which one unconsciously and tacitly attributes to 'nature's agents.' It is not a very great step from demons to 'gravity,' 'electricity,' etc. Nor is the step very significant, if the 'reasoning' remains basically the same.

The Little Boy and the Wagon

This situation is illustrated even more strikingly in the following problem based on Newton's Third Law.

> Horse A and Horse B pull on the same rope in opposite directions with forces of equal magnitude. Horse C pulls on a rope tied to a tree with the same force as Horse A and Horse B pull on their rope. Compare the tensions in the two ropes.

If Newton's Third Law is applied in this case, the correct answer, namely that the tensions are equal, is immediately obtained. But the usual verbal reaction is, 'But Horse C pulls *alone* on its rope, while Horse B is *helping* Horse A to create more tension.'

Again the word 'pull' give animistic connotations to the term 'force.' When one mentions the fact that the tree also 'exerts' a force, animistically oriented students agree only half-heartedly: 'Yes, I suppose so, but the tree doesn't *pull*. A horse *pulls*.'

How much confusion could be spared if educators prohibited the consideration of forces as exerted *by* agents or objects and talked exclusively of forces acting *on* bodies, the only forces of statics and dynamics that matter. Then of necessity such problems of mechanics would reduce to strictly mathematical interpretations in terms of vector diagrams and vector equations.

The statement encountered in the Second Reader, 'The Little Boy pulls the wagon,' deals not with newtonian mechanics but with the Little Boy's inner reactions. It has to do with the Little Boy's desires for the wagon to behave in

a certain way. Only because this inner state may exist independently of the behavior or even of the existence of the wagon, can we speak of the Little Boy as a *cause*, which 'makes' the wagon move. In the picture which excludes the Little Boy's inner state, there is nothing which makes him the 'cause' and the movement of the wagon the 'effect.' Because to the force that is exerted on the wagon 'by' the Little Boy, there is a force exerted on the Little Boy 'by' the wagon. The force of friction 'by' the earth enabling the Little Boy to move is also imparted to the earth resulting in actual acceleration of the earth relative to the wagon and to the stars. In the physical picture there is no 'agency.' There is only *a state of affairs*, which alone should be the object of investigation. In such a light all metaphysical imperatives about the 'First Cause' become meaningless.

Good Gremlins and Bad Gremlins

The next principle, involving very similar difficulties, deals with centripetal and centrifugal forces. A simple derivation based on Newton's Second Law and Euclidean geometry shows that a particle moving along a circle is acted upon by a force whose magnitude is

$$F = mV^2/R$$

and which is directed toward the center of the circle. V is the magnitude of the linear velocity of the particle, and R the radius of the circle. Thus the body (particle) is never in equilibrium. It is always being accelerated toward the center of the circle. This acceleration is a function of the force acting on it. We have

$$a = F/m = V^2/R$$

Similarly the force is a function of the acceleration:

$$F = ma = mV^2/R.$$

It is not fruitful to speak of a force 'causing' the body to move in a circle. The motion of the body may well be the 'cause' of the force. Mathematically the kindest thing that can be said about the terms 'cause' and 'effect' is that they can be taken as synonyms for 'independent' and 'dependent' variables, and if the equation allows one of the variables to be considered independent, then necessarily, either physical term may be treated as a 'cause.'

Not so, however, in the animistic thought. According to this 'reasoning,' the centripetal force 'makes' the body go in a circle, and the preposterously common misinterpretation of Newton's Third Law, coupled with the feeling of 'pull' on one's hand when an object is twirled on a string, at once creates a 'centrifugal force,' which 'opposes' the 'centripetal force' and tries to 'make' the body fly out away from the center. In one of the popular treatises on the physics of flight circulating among the cadets, I came on the following statement, which I do not remember *verbatim*, but whose gist I reproduce faithfully.

> 'When a plane is turning around a circle, two forces are acting on it, the centripetal, directed toward the center of the circle, and the centrifugal, directed away from the center. If the radius of the circle is too small for the speed, the centrifugal force may become greater than the centripetal, making the plane swerve out of the circle. It is wrong, however, to suppose that the centripetal force ever stops acting. The two always go together. It is when the centrifugal force overcomes the centripetal that the plane begins to swerve.'

Substitute 'good gremlins' and 'bad gremlins' for centripetal and centrifugal forces respectively, and you have a 1944 demonology.

The astonishing prevalence of the centrifugal force superstition is brought out

in a conversation with practically every non-mathematicising adult, who is somewhat 'acquainted' with the first principles of newtonian mechanics. It is very easy to bring him to a contradiction by just letting him explain the mechanics of circular motion. Sometimes he will grasp the words of Newton's Third Law and state that centripetal and centrifugal forces are always equal and oppositely directed, but he tacitly assumes them both to be acting on the same body. This mistake has its roots in the powerful *verbal* resistance to the idea that a body may accelerate toward a point in space *while remaining at the same distance from the point. The resistance results from the tyranny of the word 'toward' which is associated with diminishing distance. Thus* he unconsciously rejects the fact that a body moving along a circle is accelerating constantly toward the center. This in turn leads to the tacit assumption that the forces on the body are 'balanced' and to the mistaken notion about the facts of centrifugal force. But of course the balance of forces contradicts Newton's First Law. When this contradiction is pointed out, the non-mathematicising adult begins to construct fantasies about the 'struggle' between centripetal and centrifugal forces and gets entirely lost in a metaphysical mire.

'Everything is all right,' the 'popular' book on aeronautics assures the gullible cadet, 'as long as the two forces are balanced, but the moment the centrifugal force becomes too great, the plane will swerve.'

The use of scientific terms makes this 'physics' no more scientific than the use of 'scientific terms' makes astrology scientific. The 'physics' presented in these popular 'non-technical, non-mathematical' treatises really is an account of animistic wish reactions. We wish to make a plane follow a circular path; so we turn the rudder (magic), thus telling the plane what to do, and the plane 'obeys.' Now if everything is 'all right,' i.e. the 'forces' are 'balanced' (note the connotation of 'balance' with general well-being applied to the particular case of a plane moving in the *desired* path), the plane will continue to move as we wish, but the moment the 'balance' is disturbed, the plane begins to misbehave, etc., etc.

How many readers, delighting in explaining the universe to inquiring children (really few occupations are more delightful), proudly tell them that 'centrifugal force keeps the water from spilling from the bucket, if one twirls it in a vertical circle'? They may as well tell them it is Santa Claus. True, centrifugal force is a very much more useful term than Santa Claus, but the properties attributed to it in the case of the twirling bucket are simply not true.

The entire wording of the question 'What makes it so?' or 'What prevents it from doing thus?' is based on false animistic or anthropomorphic assumptions implicit in the structure of everyday language. Each repetition of such questions, and of 'answers' based upon them, strengthens these animistic assumptions and makes the full development of one's ability to absorb knowledge increasingly difficult. The widely prevalent distaste for mathematics and other comparatively exact sciences may well have its roots in this attitude.

The question, 'Why does not water spill from a twirling bucket, when it is upside down?' should be answered by such an analysis as the following:

COUNTERQUESTION: What do you expect the water to do?

PROBABLE ANSWER: I expect it to spill.

Q. Why?
A. When the bucket is upside down, there is nothing to prevent it from falling to the ground.
Q. By 'falling' do you mean moving toward the ground?
A. Yes.
Q. Why should a falling object move toward the ground?
A. I have just defined 'falling' so.
Q. What causes falling?
A. Gravity.
Q. Then, since you consider 'falling' and 'moving toward the ground' synonymous, you conclude that any object under influence of gravity alone must move toward the ground?
A. Yes.
Q. But is this true? Does the moon move toward the ground? Does a stone which you have just thrown upward? Yet both are predominantly under the influence of earth's gravity.

At this point we have supposedly shaken the animistic notion of gravity which pictures 'Mother Earth' calling, 'Come to me, my children,' 'making' all things move toward it unless opposed by other 'forces,' like the 'centrifugal force' or 'inertia,' which people confuse with force. I think it is possible to explain to a child who is mature enough to be interested in such things that a stone thrown upward is also 'falling' even while moving upward, if falling is explained to mean any motion of a body acted upon by the earth's gravity alone. (We are really equating falling with acceleration.) This generalized falling would include paths of all projectiles in vacuum, the path of the moon (neglecting the sun's gravitational field), and many other events not ordinarily regarded as 'falling.' This explanation will also help destroy some verbally acquired notions about the behavior of a stone thrown upward. These notions as held by non-mathematicising adults usually tacitly attribute animistic qualities to the stone. The unconscious or semi-conscious verbal process goes as follows:

'I threw the stone on its way. It flew up, because I threw it up (*i.e.* wanted it to go up). As it leaves my hand, it is still under my influence. (More sophisticated people rationalize this magic as "inertia"). But bye and bye the inertia (read magic) wears off, and the stone becomes more and more influenced by the "opposing force" of gravity, which finally takes the upper hand, and the stone begins to fall.'

The mathematicizing physicist on the other hand considers the stone a freely falling body (barring air resistance) the instant it leaves the hand that threw it. The path of the stone can be quite accurately predicted under these assumptions, the discrepancies being reduced as more and more refined corrections are introduced. We consider the mathematical theory of falling bodies 'truer' than the verbal explanation above, because of the relativistic and quantitative definition of 'truth.' To put it roughly, one theory is truer than another if it assumes less and explains (predicts) more. So far the truest of all scientific theories have been the mathematically formulated ones.

In my opinion, explaining to the child the phenomenon of the whirling bucket becomes possible only when the child is able to comprehend the equation that describes it. But it is possible to impart the critical notion that 'falling' does not necessarily mean 'moving toward the ground,' and that bodies do not necessarily move toward the ground even if there is nothing to oppose such motion.

When mathematicizing becomes sufficiently advanced, the term *acceleration* should be brought up immediately and

connected functionally with force in Newton's Second Law. The difference between velocity and acceleration should be constantly emphasized. After the algebraic equation for the centripetal force has been derived, the 'explanation' of the behavior of the water in the whirling bucket should involve the examination of facts and the comparison of these facts with the equation. At the instant when the bucket is in the upside down position there are two forces acting on the water: (1) the force of gravity, equal in magnitude to the weight of the water and directed *downward*, and (2) the force transmitted by the tension of the string and the bottom of the bucket, *also directed downward* (which the believers in the 'centrifugal force' fairy tale will find especially astonishing). There is no upward force at all! Since the two forces are in the same direction, their resultant is simply their sum and equals the total force on the water directed *toward the center of the circle* along which the bucket is moving. (Note that we are considering the instant when the bucket is at the top of the circle.) We now have the force acting on the body which moves in a circular path. According to Newton's mechanics, this force should equal the mass of the body multiplied by the square of its linear velocity divided by the radius of the circle, which it does. *Nothing further need be said.* The phenomenon is explained, since the elements of behavior when translated into mathematical terms satisfy the equation which predicts the behavior. All other considerations are irrelevant.

Thus it appears that the popular belief in this case is not only not in accordance with the facts but actually contrary to fact. Popular belief states that a force opposing gravity, *i.e.*, an upward force, is acting on the water when the bucket is in upside down position, when as a matter of fact, the examination of the forces in action from the point of view of an observer stationary relative to the earth shows that the only other force besides gravity acting on the water is an additional *downward* force (transmitted by the tension of the string). We shall see below that the postulation of 'centrifugal forces' is permissible but only when a different point of view (coördinate system) is chosen, but such postulation really complicates matters instead of simplying them, and the ignorance of underlying assumptions always causes confusion.

'Bottlenecks'

The next example deals with Bernoulli's principle of hydrodynamics. This principle was explained to the cadets in connection with the theory of flight based on streamlined airfoils and in connection with the action of carburetors and Venturi tubes.

Stated in qualitative terms, the Bernoulli principle of hydrodynamics implies that under conditions of steady flow, if the cross-section of the stream tube decreases, then the velocity of flow increases, and the pressure within the stream tube decreases. This last statement is evident from the equation

$$p + d V^2/2 = C$$

where p is the pressure at a given point in the stream tube, d the density of the liquid and V the velocity of flow. The equation is derived directly from the assumption of conservation of energy, the definition of pressure, and the assumption of the incompressibility of the liquid. It is within certain limits a good approximation of observed facts.

The cadets were reluctant to accept the fact that the velocity of flow actually increases in the narrower sections of the channel (they were thinking of Sunday evening traffic jams in the narrow sections

of the road and of the expression 'bottle neck'). They positively rebelled at the idea of decreased pressure. Again the analysis of the difficulty points to verbal prejudices and animistic assumptions. The main associations with the word 'pressure' is the expression 'restriction of liberty.' Hence the totally mistaken notion that pressure within the liquid must increase as it is 'forced' into a narrower channel. Again the technique was applied of analysing the verbal associations and pointing out the seat of the delusion. At this stage (fairly far in the course) the breaking down of false ideas was considerably easier.

In Boyle's law, the animistic 'cause and effect' became especially obvious. On one of the quizzes I proposed the following question:

> Other things being equal, when the pressure on the walls of a cylinder containing a quantity of gas increases, the volume of the cylinder (considered flexible) (1) increases, (2) decreases, (3) remains the same.

After disastrous results, many of my colleagues argued that this was a 'trick question,' but some agreed with me that I was bringing out an important point and phrasing the question in such a way that mathematicizing would give the correct answer, while the animistic approach would lead to a wrong one. In answering the question mathematically, one writes down the equation

$$PV = C,$$

where P is the pressure and V the volume of a quantity of gas, while C is a constant. From this formula it is at once evident that whenever P increases, V decreases, and vice versa.

Animistic reasoning goes approximately as follows:

'The gas *wants* to expand. This tendency to expand is evident in the pressure the gas exerts on the walls of its container. The more pressure, the greater the tendency to expand. Hence the greater will be the volume.'

Those of my colleagues who objected to my wording said that the question should have read 'When the pressure *on* a quantity of gas increases, its volume, etc.' But note how this wording invites the derivation of the correct answer by another animistic assumption:

'When I exert pressure on a gas, I am compressing it; hence the volume decreases.'

Why talk at all about difference between the pressure on the walls and the pressure on the gas? The two are connected by the equality sign in Newton's Third Law. Neither is conceivable without the other. The reason I worded the problem as I did was precisely an attempt to avoid the animistic 'cause and effect' notion, where the 'cause' is a conscious agency and the 'effect' is the passive obedience of the object. I wished to emphasize a functional relationship between two mathematical quantities instead of attributing to them 'wills' camouflaged by the obscure term 'tendency.'

Shifting Frames of Reference

In closing I want to take an example of extremely obscure treatment given in 'college texts' to some physical phenomena. This treatment conceals preposterous shifts of meaning, definition, and assumptions, which when consciously applied are usually called sophistry. The training of cadets in scientific thought in order to mold mentalities able to deal most efficiently with technology is only a special case of the general necessity of training the entire new generation and generations to come in scientific thinking. Once more I choose the treatment of 'centrifugal force,' that scapegoat of the inability or disin-

clination to mathematicize. Again and again one encounters in 'college texts' the statement that the weight of an object is the resultant of the 'pull of gravity' and an opposing force, the centrifugal force, 'due to the earth's rotation.'

This is a common explanation. Any believer in centrifugal force will say that it makes an object weigh less at the equator than near the poles, because the earth rotates faster at the equator. When pressed further, this believer will admit that what he is actually measuring when he is weighing an object on a spring balance is the tension of the spring. The fallacious reasoning then does its deadly work as follows:

'The tension of the spring is less at the equator than at the pole (observed fact). But the body weighed is at rest with respect to the earth in both cases. Therefore the tension of the spring equals the downward force acting on the body in both cases. But the body is equidistant from the center in both cases (the earth is assumed to be spherical and homogeneous). Hence the force of gravity acting on it must be the same in both cases according to the inverse square law of Newton. Therefore there must be an opposing force at the equator not present at the pole. This force is due to the earth's rotation, the centrifugal force, since it is directed away from the center of the earth.'

The above reasoning is riddled with contradictions. It presumes to argue on the basis of Newton's laws of motion and the law of gravity, but it rests on two contradictory assumptions, namely, that the earth is not rotating and that the earth is rotating (*i.e.*, the frame of reference shifts from one relative to which the earth is not rotating to one relative to which the earth is rotating).

To show this, note that Newton's formulation of the laws of motion and the law of gravity contains a tacit assumption, *not* explicitly stated, namely, that a system of coördinates relative to which all motion is to be considered *has been chosen.* Actually Newton chose his coördinate system somewhere at a fixed star. It does not matter which. The motion of the stars with respect to each other may be considered as non-accelerating, so that the transformation of coördinate system from one star to another leaves the laws invariant within the limits of their precision. Nor does the transformation of coördinates to an accelerated system such as the rotating earth affect the first two laws of motion, in which force is treated as a function of acceleration and therefore is a relative concept, depending on the coördinate system chosen. However, the transformation of coördinates to an accelerated system such as the rotating earth does significantly affect Newton's Third Law and the law of gravity, because in the formulation of these laws force is *not* a function of acceleration! So that any reasoning which involves the assumption of a stationary earth cannot also assume the validity of either Newton's Third Law or the inverse square law of gravity without assuming additional corrections. But the centrifugal force argument does assume a stationary earth in that the body weighed at the equator is considered at rest relative to the 'earth.' The phrase 'at rest relative to the earth' has no meaning if a rotating earth is assumed, because a body at rest relative to the surface of the earth is not at rest relative to the center, since every point on the surface suffers an acceleration toward the center. But the argument above first considers the earth stationary, then proceeds to conclude the existence of a force due 'to the rotation of the earth.'

It is, of course, possible to make either

assumption, but one must swallow the consequences. Let us begin with the assumption of a rotating earth, *i.e.*, let us say our frame of reference is Sirius. In this case the inverse square law is valid, but the object weighed is not at rest relative to the center of the earth. It suffers an acceleration. Therefore the forces on that object are not balanced; the downward force of gravity is greater than the upward tension of the spring, and the phenomenon is explained. It is, of course, immaterial whether we define the 'weight' of the object the tension of the spring or the pull of gravity. We were primarily interested in explaining the difference in the tensions of a spring balance at the pole and at the equator. Note that no 'centrifugal force' enters the argument.

Now let us proceed on the other assumption, namely, that the earth is stationary, *i.e.*, our frame of reference is at the earth with the origin at the center and the axes through particular points on the surface. If this assumption is made, the inverse square law is no longer valid, because it is not invariant under the transformation of coördinates to accelerated systems. One could still assume the inverse square law and *correct* it by introducing a force throughout the universe which would correct it. This force would behave at the surface of the earth as the abovementioned centrifugal force. Consequently, the hypothesis of 'centrifugal force' may enter the argument only if the earth is assumed *not* to rotate. How then is the centrifugal force considered as being 'due to the earth's rotation'? Rather the following explanation would have some justification: 'I have to introduce "centrifugal force" when I shift my hypothesis from a stationary earth (when I consider the object weighed at rest relative to the center) to a rotating earth (when I assume the validity of the inverse square law) and am not aware of what I am doing.'

This patches up the 'centrifugal force' explanation of the loss of weight at the equator. But is it simple? Is it elegant? Is it valuable? Is it healthy? Why not mathematicize instead? Why not state one's postulates explicitly and in advance as demanded by scientific honesty? There is a whole world of phenomena to be satisfactorily explained by newtonian physics and euclidean geometry without recourse to more advanced ideas of relativity theories, if one is careful in the translation from mathematical language (on which physics and geometry are rigorously based) to our sloppy ordinary languages.

Just one more word about the verbal difficulties of the last problem. If a rotating earth is assumed (the simplest assumption, if the problem is to be treated by newtonian theory), the verbal answers to the question about the difference in weight of an object at the pole and at the equator would run thus:

QUESTION: Why does this object weigh less in Peru than in Alaska?

ANSWER: What do you mean by 'weight'?

Q. The force of gravity acting on the object.

A. It is not less; it is the same.

Q. Why then is the tension of the spring balance less?

A. In Peru the tension of the spring balance is actually less than the force of gravity.

Q. Why?

A. Because in Peru the object is accelerating toward the center of the earth more than in Alaska. Actually in Alaska there is also a difference between the weight and the tension, but this difference is smaller, because the acceleration is smaller. Only at the pole is the

object at rest relative to the center of the earth and the two forces are equal.

Note that the gist of the dialogue is this:

QUESTION: Why are the forces on the object not balanced?
ANSWER: Because the object is accelerated.

The usual animistic interpretation of force demands the reversal of this 'why' and 'because.' According to this interpretation the answer is perfectly understandable if the question reads, 'Why is the object accelerated?' and the answer is 'Because the forces are not balanced.' This, you see, is proper. Force is a *cause;* acceleration the *effect.* The unfortunate formulation of Newton's First Law (or its wrong interpretation) in which uniform linear motion is implied to be 'natural' and forces are treated as disturbing influences, *causes,* has done a great deal of harm in strengthening the cause-effect delusion. Its roots are deep in theology and demonology. It appears that an important problem of education is to deal this delusion decisive blows and to prevent its domination of our semantic reactions.

The importance placed by the Air Training Command on the preparation of future flyers in scientific thinking habits is reflected in the emphasis placed on mathematics and physics courses in their training program. The actual value of scientific thinking in a person engaged in combat is, of course, almost impossible to evaluate, because of the absence of controled observable data. We can only surmise that such training is valuable by analogy with the industrial field, and by noting that all purposeful human activity depends on organization and on the sanity of the individuals engaged in it.

The cadet has a perfect right to ask, 'Do I have to know this to handle a stick?' No arrogant answer about 'knowledge for the sake of knowledge' which some university professors from the time of Euclid have indulged in, is justified here, for the cadets are trained for one thing only—to defeat the enemy in the air and from the air, and any effort which is not somehow connected with this end is wasteful. It is only later, when overseas I had the pleasure of observing some of the students we had taught, that I began to believe what I had told the cadets when I used to teach them, that winning the war was not just 'handling the stick,' and that the few ideas about the value of mathematicizing that we tried to impart into those young men who passed through our classrooms at Maxwell Field, meager as they were, were nonetheless valuable if successfully absorbed in enabling the nervous systems of $Smith_1$, $Smith_2$, etc., to resist the poison being generated by the nervous systems of $Schulz_1$, $Schulz_2$, etc.

To what final conclusions are we then led respecting the nature and extent of the scholastic logic? I think to the following: that it is not a science, but a collection of scientific truths, too incomplete to form a system of themselves, and not sufficiently fundamental to serve as the foundation upon which a perfect system may rest.

GEORGE BOOLE, *Investigation of the Laws of Thought*

THE PERSONALITY DEVELOPMENT OF A STUTTERING BOY

NELL WILL*

SPEECH pathologists know more about stuttering than they once did, and perhaps because of this, they are less sure of their theories. Enough laboratory and statistical investigations have been performed to demonstrate not only the value, but also the limitations, of various approaches, and the results have implied that such studies might profitably be supplemented by thorough-going individual case studies.

What such individualized investigations can indicate is the pattern of functional relationships that make the individual, and the statistical data concerning the stutterer, meaningful to the speech correctionist. Moreover, what the speech correctionist does specifically in particular cases to modify these relationships, and therefore modify the stutterer's behavior, is in turn, because of its observable effects, instructive to the laboratory scientist. The problem cannot be effectively approached either through the laboratory alone or the clinic alone.

The following report is presented in accordance with this point of view. It covers a period of six months from October, 1942 through March, 1943. The report concerns a thirteen-year-old boy, who had stuttered for seven years, and it describes the procedures and the effects of a six-month program of retraining.

Description of the Case

When the boy was first seen by the writer in October, 1942, he exhibited great tension during stuttering. His hands were clenched as if he were holding tightly onto something. As he tried to speak, he would block with a hissing sound, his whole face tensed, his jaws filled out, his eyes opened wide, and the balls of his eyes rolled upward. He appeared to gasp for breath as he sucked in air through his mouth and then tried to force out the word. His entire body was rigid. His arm and leg muscles felt extremely hard.

He did not talk on the telephone; he avoided social situations; he could not recite in the classroom. The teachers did not know what he was really capable of doing. The mother expressed antagonism toward one of the teachers who did not seem to know how to help the boy, and the principal thought the mother shielded the child from facing his own problems.

Case History

Born the second child, into a happy home of above average socio-economic status, above average social and moral standards, the child at an early age tried

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to reach the level of performance of his sister, three and one-half years older. The influence of a grandmother's partiality to the boy perhaps increased the sister's jealousy of him. His companionship during the preschool years consisted mostly of children of the sister's age level. The boy developed eczema at two weeks, which medical treatment has been unable to check. During the summer months the eczema became severe; infection often resulted which made it necessary to bandage his arms. He attended kindergarten where he was one of the youngest in his group.

The mother did not remember being aware of the child's stuttering until he was in the first grade, where he was again the youngest of his group. He entered first grade at midyear. During the summer following (1935) he was referred by a psychiatrist to the State University of Iowa Speech Clinic for treatment of stuttering. Since 1935 he has been treated by various clinicians and by various methods. Each time his environment was enlarged his condition became worse. According to the mother, he has had some fluent periods (we could not find this to be definitely true in school and in social situations). But each time a new situation, particularly in school, or in a more or less formal sense in society, presented itself, he became more tense and fearful and less able to speak.[1]

A woman neighbor remembered him as a little boy, who in the summers had his arms and hands bandaged in white cloths from his fingers to his elbows. He sold vegetables at an early age and often came to her house. The woman's daughter felt sorry for the child and talked to him, realizing that some adults and many children shunned him because of the conditions of his arms, fearing he had a disease which they might get. Other children actually ran away from him. During those years he stuttered badly.[2]

Another neighbor, a well-educated man, who had seen the boys over a period of ten years, remarked, 'When that boy was younger he seemed a little queer. He was shy and unwilling to look you in the face. He didn't seem to have good physical and mental coordination. He was undersized and looked funny on a bicycle. His face was often scratched and scabby—if we hadn't known he was from a nice home, we would have thought he came from a dirty home. There was a striking difference between the boy and his sister. She was very bright, attractive and alert.'

When he entered junior high school in February, 1941, his stuttering became very pronounced. In the summer of 1942 he attended a scout camp, from which he returned in a state of great anxiety.[3] This was his first lengthy experience away from family or relatives.[4]

By October, 1942, he was in the serious condition of exaggerated blocking in which the present clinician first encountered him.

Treatment[5]

'Treatment was approached by consid-

[1] G. Devereux. 'A Sociological Theory of Schizophrenia.' *The Psychoanalytic Review*, xxvi (July, 1939), 315-342.

[2] A. Adler, *Understanding Human Nature* (1927). On p. 69 the problem of organ inferiority in relation to personality development is discussed in a way relevant to the present case.

[3] K. Horney, *The Neurotic Personality of Our Time* (1937). Particularly on p. 44 the dynamics of anxiety are well presented.

[4] Ibid., *New Ways in Psychoanalysis* (1939), chapter 12 on.

[5] The clinical work with this case was carried out at the State University of Iowa under the supervision of Wendell Johnson.

ering the child in his total environment.[6] The factors mentioned, in relation to tension and striving, such as high goals set by the environment at the pre-school age, competition with and jealousy of the sister, diagnosis of stuttering in the first grade,[7] and failure on top of failure[8] in all life contacts since six years of age, were all considered in planning the treatment.

The treatment consisted of approaching the child from two angles: from 'within himself' and from his environment. These are artificial classifications for purposes of analysis only. It is impossible to discuss one without considering the other, or to affect one without affecting the other. Thus considerable overlapping of the two will be found in the following discussion.

Treatment from 'Within Himself' (Extensionalization and Re-evaluation)[9]

First, this treatment consisted of making the child feel that he was a worthy individual by looking up to him and by making him feel that what he had to say was important.

Second, he was given certain tools with which to attack his fears. These tools consisted of (1) semantic relaxation[10] (2) improved word-fact relationships[11] (3) changing of the child's attitudes toward himself as a personality[12] and (4) changing his attitudes toward his speech.[13] Under this fourth heading we attempted to get him to assume the attitude of not caring if he did stutter or hesitate, and to be willing to accept nonfluency such as th-th-th-this.

Although these topics are discussed separately in this report, they were all used together in the actual treatment.

The first step in the treatment was to change the child's attitude toward himself. An intelligence test was given and the results interpreted to him. (The I.Q. was 112, as measured by Form L of the 1937 revision of the Stanford-Binet Intelligence Test.) He was made to realize that his poor school performance was not due to inferior ability but to anxiety about speaking. Every reasonable effort was made to make him feel that he was a worthy individual. In general, the clinician treated him as she would an adult guest in her home and she insisted that others do the same.

Also, keeping in mind the necessity of carrying this treatment into the child's total environment, an effort was made to induce certain key people to adopt this same policy toward the child. This attitude permeated every situation set up for him.

The second step of treating the individual from 'within himself' was train-

[6] K. Lewin. *A Dynamic Theory of Personality*, p. 71, on interrelationship of the dynamic factors concerned in behavior.

[7] W. Johnson, 'A Semantic Theory of Stuttering' *Stuttering, Significant Theories and Therapies*, edited by E. Hahn (Stanford University Press, 1943).

[8] R. R. Sears, 'Success and Failure.' *Studies in Personality*, Q. McNemar and M. A. Merrill, editors (1942), pp. 235-258.

[9] A. Korzybski, *Science and Sanity*, Intro., p. xxviii, 'Psychotherapy, no matter of what school, is based on the partial and particular extensionalization of a given patient'; pp. 171-182 on Extensionalization; Intro., pp. xiv-xvi on mis-evaluations; pp. 196-197.

[10] C. Schuchardt, *The Technique of Semantic Relaxation* (Institute of General Semantics, Chicago, February, 1943).

[11] S. I. Hayakawa, *Language in Action* (1941).

[12] C. R. Rogers, *Counselling and Psychotherapy: Newer Concepts in Practice* (1942), pp. 31-216.

[13] C. Van Riper, *Speech Correction: Principles and Methods* (1939), pp. 347-348.

ing in semantic relaxation. Semantic relaxation is done without speaking. The boy was asked to sit on the edge of a straight chair. He was taught to examine in a gentle way with his hand the head, face, and neck muscles in order to become aware of the amount of tension. It was pointed out to him that when a muscle is tense, the skin tends to be cold and moist, whereas a relaxed muscle makes for a warm, dry, soft, and flexible skin. Then as a relaxing procedure he was taught to grasp with the whole hand each of these muscles in turn in an easy and gentle way as if doing it to a three-year-old child, to shake each muscle gently with a soft hand, using wrist movement. He practiced semantic relaxation regularly before he read to the mirrophone, or before the mirror, or before a clinical group. The first time he was relaxed, he put his head down on the desk and mentioned that he was so tired he wanted to go to sleep, and he proceeded to do so. This type of relaxation was carried by him into the home and school situations. He was requested to do it many times daily, even in the classroom. By this technique he became able for the first time to relax and to recite in the classroom. Previously he had sat in a state of anxiety thinking about when the teacher would call on him, thus working up such a degree of fear that when he was called on he could hardly say a word.

Another tool to help attack his fears was improved word-fact relationship. He was taught to describe facts in as simple a way as possible. He was asked not to memorize words, or verbal forms, as an aid in speaking, but rather to think about the definite object or thing to be spoken about and then as he visualized or otherwise remembered it to talk about the facts in a simple, orderly manner. If he was talking about a particular game, for example, he would stand on his feet, visualize the game and then describe it simply as he actually remembered it. Facts first, then description of facts second, would appear to be the natural order of the nervous system. This type of approach seemed to give him confidence and to reduce his fear of speaking. His fear of not remembering words was erased. He soon became able to stand on his feet and think about the facts before saying any words. He remarked, 'When I began to be able to talk, my classmates listened to what I had to say. I had noticed that they had often looked out of the window when some of the other talks were being given.' It was obvious that he was able to hold the attention of graduate classes in the university when talking to them about his past fears of speaking, etc. In fact, from having spoken several times before such classes he has gained a reputation for being an unusually effective and impressive speaker for his age.[14]

Still another tool given the child was to change his attitude toward his speech from the fear of stuttering to the realization that hesitations are normal in fluent speakers.[15] As an example, he observed a six-year-old child use the mirrophone, a machine which records the voice and plays it back like a record player. He listened to the child's voice as the machine was played again and again. The many normal hesitations of the six-year-old were noticeable. It seemed to relieve him to have these normal speech imperfections pointed out to him and explained. It was mentioned that no atten-

[14] K. Lewin, *Principles of Topological Psychology* (1936).

[15] D. Davis, 'The Relation of Repetitions in the Speech of Young Children in Relation to Certain Measures of Language Maturity and Situational Factors.' *J. Speech Disorders*, IV (1939), 303-318, and V (1940), 238-246.

tion had been called to the six-year-old's hesitations, as had been done when the boy in this case was six years old. He had been called a 'stutterer' because he hesitated in a similar way. As another example of normal hesitations in speaking, he observed an adult use the mirrophone and then he played the recording several times. The hesitations of the adult were many, yet they were normal hesitations in speech.

We succeeded to a marked degree in getting him to assume the attitude of not caring if he did 'stutter' or hesitate, and to be willing to accept nonfluency. An example of this nonfluency is the so-called bounce technique; the child is taught to repeat deliberately on the first syllable of each word (one form of controlled speech). Since the boy had developed great fear of normal hesitations in his speech, as evidenced by his stuttering and tension, it was very difficult for him suddenly to be willing consciously to speak hesitatingly after seven years of fear of stuttering.

It was not enough that the child himself accept nonfluency, but it was also necessary that he feel the people to whom he spoke accepted it as a satisfactory way of speaking for him. In view of this, the child was asked to talk to his sister, his parents, his principal, his teachers, his scout leader, and his close friends about this conscious hesitating as an important step in overcoming his speech tension, as a step in facing an overwhelming fear, as a step in unlearning reactions that had been well learned. In order to get these key people to be willing to listen to the boy in an understanding way, the clinician interviewed each of them and solicited their interest and cooperation, explaining that whatever improvement the boy might make would be due to their understanding of him and of his attempts to turn failure of speaking into attainable success—his attempt to be nonfluent as a step in overcoming his fear and tension. Careful follow-ups were then made to be sure that an acceptable attitude was being taken by these key people toward the boy's conscious hesitations, toward his acceptance of nonfluency in an easy relaxed manner as a satisfactory means of talking. These key people were asked to compliment the child on the nonfluency when he did it in an easy relaxed way and to laugh in a friendly way with him about his fears.

After thus preparing the way, the child was led to talk about his stuttering to his family, friends, teachers, scout leader and also to strangers; to be willing to take advantage of all available opportunities to speak either in person or on the phone; and finally to be able to accept and enjoy social contacts so that more of them would be desired and planned for.

Treatment by Modification of Environment[16]

In the plan of treatment of the child from the standpoint of his total environment, attack was made at the places where the child had experienced the most failure, where he had received the most humiliation, where he had been thought inferior, where he was the most insecure. Some indication of what was done in this connection has already been given. First,

[16] M. E. Kenworthy and P. Lee, *Mental Hygiene and Social Work* (1929), p. 133. 'If any bit of successful social treatment is analyzed, however, it will be seen that its success lies not only in the use of the facts and concepts of psychiatric and social science, but quite as much in an ingenious and imaginative use of a multitude of minor devices, emphases, suggestions, etc., which collectively have furnished the basis of an effective relationship between the worker, the patient, his family and others.'

attention was given to the school situation; second, to social situations; and the home treatment was coordinated with the other two programs. So-called key people were selected in the child's environment: namely, the parents, the sister, three of his teachers, the school principal, the scout master and a friend. The attempt was made to get each of them to change his or her attitude toward the boy, by re-evaluating the facts about him. Rapport was carefully established. Their opinions and information about the boy were secured. They were made to realize that they could play an important part in helping the boy overcome his fear and tension about speaking, that what they were to do could not be done by anyone else, and that the amount of improvement the boy made would be in proportion to their interest and cooperation. First of all, the clinician made clear certain facts about the child: (1) organically there was nothing wrong with him except an eczematoid condition which has been prevalent since infancy; (2) the child had normal intelligence even though he was at the failure mark in some of his school work; (3) there was nothing wrong with his speech mechanism; (4) his stuttering had developed after someone in his environment had changed that environment drastically for him by evaluating him as a stutterer; (5) after someone had evaluated the normal hesitations in his speech as stuttering, the child tried to talk without normal hesitations (which is impossible) with the result that more tension and fear accumulated to the point where he could hardly talk at all.

Second, the clinician made clear the part these individuals could play in helping the child (1) by complimenting him whenever he seemed relaxed, easy, not in a hurry; (2) by their acceptance of nonfluency performed in this easy relaxed way as a satisfactory way for the boy to speak; (3) by being willing to listen to the child talk (using the bounce technique) about his speech in the attempt to face his fear of speaking and to laugh with him in a friendly way about it; (4) by treating him as a friend; (5) by complimenting him on the use of the bounce when done by him in an easy, relaxed way; (6) by getting him to talk about facts or objects and not about words as such; (7) by providing situations in which he could have success in speaking; (8) by providing new speaking situations for him and (9) by their example getting others around them to change their attitudes toward the boy.

Following are examples of work done and the resulting adjustment (1) with the sister (2) in junior high school (3) with the scout master (4) on a scout trip (5) with a friend (6) on a job (7) at a school party and (8) in senior high school.

1. *Work done with the boy's sister.* An attempt was made to change the attitude of the sister toward her brother. We asked her to listen in a calm way to the boy when he explained to her about his speech and to laugh pleasantly with him about his stuttering. We complimented the girl whenever she showed signs of regarding the brother as a friend at his own age level rather than as a competitor at her age level. We urged her to listen to him read and to compliment him on the use of the bounce technique, or nonfluency, when he did it in an easy, relaxed manner. We were able to get her to help him review his daily school work with a view to helping him raise his grades and providing more speech situations with her. When the boy entered senior high school in Feb-

ruary, 1943, he took his sister to the first dance at the school and they both had a good time.

2. *School situation.* The child was asked to talk to his civics teacher (this teacher was chosen as his adjustment in this class was the most difficult) about his stuttering and to arrange for the clinician to see her. The clinician found that the civics teacher knew practically nothing about the child except what was indicated in the records of her grade book, which showed his present grade at the failure mark. The clinician explained about the child's fear of speaking and suggested that she help him face these facts. We recommended that the teacher be a friend to the boy and listen to him when and if he attempted to talk. Then when the boy approached her she was ready to listen sympathetically to his story as to why he stuttered and what he had to do to overcome it. She complimented him when he used the bounce in an easy relaxed way in telling the class his story. At first he showed considerable tension when he got up before the class, but he noticed the teacher's approval and got through his first speaking situation before his class with a measure of success. This was his best success with his age group in seven years of stuttering and fear of speaking. As a matter of fact, it was the very first time he had ever attempted anything that could be called 'speaking to an audience.' When a couple of boys in the room began to laugh, the teacher frowned on them, and in the end the talk was turned into something of interest to the class as well as success for the boy. She complimented him on the use of the bounce and his lack of tension. The next day he gave another talk to the same class, and other talks followed. By the end of the semester, early in February, 1943, he had raised his class grade in addition to overcoming his fear of speaking in the classroom.

3. *Scout Master.* On one occasion the boy was asked to talk with his scout master about his stuttering, why he did it and what he had to do to overcome it. The child tensed and said his scout master was busy. He was, in fact, a busy man but we got in touch with him. He said that for ten years he had been a friend to the boy's father but never once had he had, or created, an occasion to discuss the stuttering with him. In talking about the boy's stuttering, he remarked that in scout meetings 'not only does the boy stutter when he tries to talk, but at times he just can't say a word.' We gave the man some knowledge of the boy's condition and told him how he could aid. The scout master found the time and opportunity, and the child talked with him (using the bounce and showing some tension) for fifteen minutes. The child later remarked to the clinician with great enthusiasm, 'I talked to my scout master about my speech for fifteen minutes. He wasn't hard to talk to and he listened to every word I said.' This gave the boy courage to face other difficult speech situations.

4. *Scout Troop.* A week later the scouts were having a three-day camp at their cabin in the country. The child did not want to go, saying it was too expensive. But when the clinician suggested to the father that it would be a good experience for the boy, he overrode the financial objections. The boy's assignment was to talk to his camp friends about his stuttering, about his fear of speaking. In reporting afterwards he said that he had been puzzled as to how he

might bring up the subject of his speech with the five boys at the camp, but then he remembered that one of the boys had a young sister who stuttered. So he asked, 'How is your sister getting along at the speech clinic?' Then he talked to his camp friends about his own stuttering. His reaction to the experience was very good, showing that he had achieved some measure of success in facing his fear in a situation where in the summer he had had complete failure.

5. *A friend.* On one occasion the boy was requested to talk to a girl who is a friend of his sister. Although he had known the girl for many years, he did not want to do the assignment. A small social group was arranged at the clinician's home, where several university students who stuttered were present, and the sister's friend was present on the pretext of looking after the clinician's son. The boy was asked to talk to the girl about his stuttering, why he did it and what he had to do to overcome it. The girl had been coached to listen to him in a genuinely friendly manner, and to notice with how much ease he was using the bounce technique and to compliment him on his lack of tension. All the students at the party who stuttered were required to use the bounce, and in order to make the stutterers feel more at ease, some of the other people present also used it, the clinician included. The boy seemed to have mastered the bounce technique that night. He did it with more ease and less tension than any of the older students who stuttered. The group played the piano, sang songs, told stories and 'faked' blocks on the telephone. Five of the people present did not stutter but were good listeners.

Later at another party at the clinician's home, the boy was instructed to listen to the other stutterers and give them every opportunity to practice the bounce. He was very cooperative in this way.

6. *On a job.* By Christmas vacation in December, 1942, the boy was almost entirely over his fear and tension about speaking. He secured a job, doing errands at the Navy Pre-Flight school. He was urged to take advantage of every opportunity to talk to the cadets about his speech. He continued at our request to speak nonfluently part of the time when talking to cadets. He had many opportunities to talk to the Naval students about his speech. He continued to erase further his fear by facing it. In talking to the clinician about it, he said at this stage, 'I have no tension, I can talk like anyone else.'

7. *A school party.* Early in February, 1943, he left the junior high school at which time a farewell party was given for his class. He was chosen and served on the entertainment committee. He had his first date. Three boys and three girls went together to the party. Since that time he has had many dates. In speaking to the clinician about the party he said, 'I had a wonderful time.'

8. *Senior high school.* After graduating from junior high school in February, 1943, he entered senior high school which is located in another part of town. His English teacher, who has known him for the first time since February, 1943, cannot believe that he ever did stutter. She remarked, 'He is one of my best students from junior high.' His algebra teacher was surprised to learn that he had formerly stuttered. His grades for the first six weeks were above average.

Summary of Results[17]

1. The child now appears to have no more tension, possibly less, than the average child of his age.
2. He has stopped crying at home. (Formerly he cried often.)
3. He has a better relationship with his sister.
4. He keeps company with girls in a way that seems at least average for his age.
5. He goes to school dances and social functions to an extent and with satisfactions that seem to be average for his age.
6. He has the attitude toward his speech: 'I don't care if I do hesitate.'
7. He seems to be almost as fluent as the average normal speaker—not only in the clinic but in all of his speech situations.
8. He has confidence in himself as a speaker, being willing and eager to face new speech situations.
9. He speaks with ease, to university classes, answering their questions confidently and effectively, occasionally using the bounce (controlled nonfluency).
10. His study habits are improved.
11. His penmanship is tremendously improved.
12. His school grades have been raised considerably.
13. He has made a very good adjustment in a new school situation.
14. He has made his first satisfactory school adjustment since he started to school seven years ago.

[17] I wish to acknowledge my debt to Laila Packman.

Now, the mental antipathies of men, like the fears of men, are very elemental, widespread, and momentous mental phenomena. But they are also in their fundamental nature extremely capricious, and extremely suggestible mental phenomena. Let an individual man alone, and he will feel antipathies for certain other human beings very much as any young child does—namely, quite capriciously—just as he will also feel all sorts of capricious likings for people. But train a man first to give names to his antipathies, then to regard the antipathies thus named as sacred merely because they have a name, and then you get the phenomena of racial hatred, of religious hatred, of class hatred, and so on indefinitely. Such trained hatreds are peculiarly pathetic and peculiarly deceitful, because they combine in such a subtle way the elemental vehemence of the hatred that a child may feel for a stranger, a cat for a dog, with the appearance of dignity and solemnity and even of duty which a name gives. Such antipathies will always play their part in human history. But what we do about them is to try not to be fooled by them, not to take them too seriously because of their mere names. We can remember that they are childish phenomena in our lives, phenomena on a level with the dread of snakes, or of mice; phenomena that we share with the cats and with the dogs, not noble phenomena, but caprices of our complex nature.

JOSIAH ROYCE, *Race Questions, Provincialism, and Other American Problems* (New York, 1908), pp. 47-48

THE TYRANNY OF PREMISES

STEWART W. HOLMES

IT has been observed that common sense and science are practically synonymous in the early days of a culture, but that as scientific investigation begins to peer beneath the surface of things, a gap develops between these two fields of knowledge, a gap which increases in geometrical ratio as time goes by. Today, as the sciences, especially the natural sciences, utilize non-aristotelian languages to an ever greater extent, while the 'laymen' continue within the narrower limits of the old aristotelian system, the gap is widening faster than ever. In a democratic society such a condition is dangerous, especially in those fields of knowledge most immediately effecting everyman—politics and education.

An example of how lack of up to date knowledge and lack of an adequate language may produce confusion is contained in a comprehensive article on education in *Fortune* magazine of July, 1943. The author writes:

> What we want—judged in terms of what we most seem to lack—are graduates capable of independent thinking, graduates willing to participate in civic life (willing, that is, to sacrifice personal convenience to group welfare), graduates with an understanding knowledge of the country and the world.
>
> If these are our aims, we shall know what to decry. We shall decry any form of education that treats the student as an organism that needs to have its reflexes conditioned with a dosage of facts and suggestions. Indeed, too much of our schooling aims at having the proper emotions run in the students' well conditioned minds when they hear slogans and catchwords. The participation of people in their government has no point if they are incapable of independent thinking; if human beings can only react to outside stimuli, if they can only think what they are told to think, then we should frankly admit that democratic ways of life are without sense and should make no pretense of trying to educate children for them. . . .

The author of the article then goes on to suggest a desirable program of education:

> We shall face the task of training the student to think critically and to act civically. One of the most foolproof ways of training him to think is to introduce him to ordered units of thought; indeed, the best way to learn how thinking should be done in the present is to study the way in which it has been done in the past, to study, that is, the great writers, the great mathematicians. . . .
>
> The child needs to be introduced to men who have written and acted in terms of ethical values. . . . Citizenship is more a matter of inclination than of information. . . . The school . . . can give him a discipline of mind that enables him to understand and to retain what he sees and what he reads.

The author sets up a bad and a good kind of education. The bad sees a student as 'an organism that needs to have its reflexes conditioned.' The good believes in 'introducing' the student to certain examples of thinking so that he will 'think' in the proper way. The bad wants to evoke the 'proper emotions' ('proper' used ironically, presumably) in a well-conditioned mind. The good would train the student to 'think critically.' The bad would have human beings react only to outside stimuli; the good would make citizenship 'more a matter of inclination than of information' (the 'inclination' presumably arising from within). The bad 'doses' the future citizen with 'facts and suggestions'; the good gives him a 'discipline of mind.' If the bad type is the only one, then democracy is a vain dream.

Let us look closely at these either-or statements. The 'bad' education gives doses of facts and suggestions which operate to produce the proper emotions as the ringing of the bell produced saliva in Pavlov's dogs. The 'good' education is not so much interested in information as in disciplining the 'minds' to have the correct 'inclination.'

Both types look pretty much the same through this verbal fog. The outside stimuli to which alone the products of the bad type would react—what are they outside? From the point of view of the organism-as-a-whole-in-an-environment, where does inside end and outside begin? And what is the difference between the 'inclination' of the good student and that-which-does-the-reacting-to-outside-stimuli in the bad? Or perhaps the good student does not react to any outside stimuli (a pretty picture of catatonic dementia). Since only the bad type 'doses' the student with facts and suggestions, perhaps the product of the good type does not know enough of the outside world to react to it, but dwells, like some of his examples of great thinking, in his own verbal world. Yet the 'discipline of mind' he 'gets' enables him to understand what he 'sees.' If, as modern epistemologists agree, what we see is dependent upon the nervous system of the observer as well as upon what is outside the observer's skin,* then the good type of education gives the student the ability to understand what he has been disciplined to understand. This is known as 'independent,' non-conditioned thinking without which democracy is a vain dream! One might add that such talk makes any science of education a vain dream.

There are four terms here that do much to foster the confusion: 'reflexes,' 'conditioned,' 'thinking,' and 'emotions.' The terms 'thinking' and 'emotions' are aristotelian, elementalistic terms which split verbally what can never be split on the non-verbal level—the evaluating human organism. Uncritically following the structural implications of an outmoded terminology, the author (who is far from being alone in his error) believes that bad education deals with the 'emotions' mostly; the good with 'critical thinking.' Under the circumstances it is hardly to be wondered at that his conclusions turn out to be meaningless.

Plainly, there can be no 'thinking' without 'feeling' nor 'feeling' without 'thinking'; but the notions of conditioning and reflexology, with the underlying problem of determinism are less simple and less apparent. We gather that the author of this article believes that all reflexes are on the low level of the patellar reflex and that all conditioning produces reactions in a one-to-one ratio. Furthermore,

* As Walter Lippman more neatly puts it, 'For the most part we do not first see and then define, we define first and then see.'

he believes that to give a student 'discipline of mind,' to train him to 'think critically' by introducing him to ordered units of thought is not to condition him!

It is interesting to observe how so many people in America proceed on the unconscious assumption that a man can do almost anything he wishes to do, that the conditioning environment is almost completely ineffective. From rags to riches, from log cabin to White House! Whether a man succeeds or fails is his responsibility and quite within his power to determine. Our penology was founded on the idea that threats of punishment to the individual rather than adjustment of crime-breeding social conditions is the answer to the problem of wrong-doing. The notions of conditioning and determinism seem to be repugnant to us. Hence, when even so enlightened a person as a writer for *Fortune* speaks scathingly of 'reflexes' and 'conditioning,' but approvingly of 'disciplining,' 'training,' 'introducing to ways of thinking,' we realize vividly how well conditioned he is to current verbal taboos. We realize also how cabined, cribbed, confined he has become through the lack of an adequate language of relation and structure.

The author has been forced by his linguistic environment to evaluate in the old behavioristic ways of formulation. If our author had utilized a vocabulary of order such as is offered in general semantics before he started writing, he would not have fallen into the confusion exhibited above nor would he have led his readers to suppose that having their children disciplined by being introduced to the Hundred Best Books in our established schools and colleges was going to enable them to sit down in an environmental vacuum and summon up a host of completely original ideas.

Korzybski has formulated the notion of different *degrees of conditionality* which include all orders of living things. He regards all activities of living things as responses or reactions to stimuli in the plenum of the organism-as-a-whole-in-an-environment. These reactions are capable of varying *degrees* of adjustment (and hence are called 'conditional' rather than 'conditioned'), and may be arranged on graduated levels of complexity and conditionality. The arrangement is made from observations of the reactions of plants, animals, undeveloped, 'mentally' ill, and sane human beings. Concerning the language used to describe these relationships, he writes:

> We can extend the vocabulary of conditional reactions to humans in all their functions. . . . Otherwise we find ourselves saddled with a vocabulary which does not correspond in structure to the well-known elementary facts concerning *human* responses to stimuli, and we relapse into the old 'behaviorism,' which is structurally insufficient. . . .
>
> With this structural verbal [multi-ordinal] extension, we can easily be convinced that everything that we call 'education,' 'habits,' 'learning,' etc., on all levels is building up acquired or conditional semantic reactions of different orders, as one of the differences between 'man' and 'animal' consists in the fact that humans can extend their symbolism and responses to indefinitely high orders, while with animals this power of abstracting and response stops somewhere.

What is true of animals is also true of 'mentally' ill persons whose reactions exhibit an abnormal degree of persistence and *un*conditionality. Apparently what the *Fortune* writer meant may better be expressed thus: the 'bad' education tends to produce automatic, animalistic re-

sponses, reactions of a low degree of conditionality, while the 'good' type is one which will condition people toward the ideal of infinite-valued and potentially fully conditional reactions of higher orders. All the way up the ladder of orders of reaction, the results are obtained by a conditioning process in a deterministic world.

And here we touch upon the final and most fundamental point of correction. A denial of higher order, infinite-valued reflexes and conditioning and a holding to the notion of 'independent thinking' implies assumptions of indeterminism. This is a serious flaw in any set of premises of a supposedly serious statement. Determinism is essential for scientific investigation since predictability and the search for structure depend upon this assumption. As regards the individual, Freud has shown how our reactions have either conscious or unconscious 'causes.'

The notion of indeterminism exists fundamentally because we lack knowledge. If we understood the colloidal interplay between the impalpable and the palpable aspects of a human being, if we knew every element that had some relevance in producing a given attitude or action, we should see the wonderfully complex causal matrix of that attitude. As Korzybski writes:

> If we abandon the problem of the two-valued 'determinism' in connection with such a fictitious isolated individual, and apply infinite-valued determinism to an actual, non-isolated individual, we see at once that the whole situation is different. If parents and society accept infinite-valued determinism, they realize their own *responsibilities* toward the individual, and understand that the actions of parents, society, etc., are to a large extent, responsible for the future development of the child on quite deterministic psychophysiological grounds.

The relevancy of this point of view to education and the applicability of this non-artistotelian vocabulary to discussions of the subject seem to me crucial. If we are to expect to reach scientifically valid answers to our problems, we must start from scientifically acceptable premises. And if we are to make sense within our own nervous systems and to those around us, we must use a language which is similar in structure to the world which it represents.

We know$_{1944}$ that protoplasm has certain functions, that nervous systems in plants, animals, and human beings react in certain ways in which there is a hierarchy of degrees of conditionality of reaction, from the completely automatic on up. In Korzybski's words:

> The suggested extension of the reaction vocabulary would allow us, at least, to apply a uniform physiological language to life, *man included*. We should have a general language for life and all actvities, 'mind' included, of a structure similar to the known protoplasmic and nervous structure, not excepting the highest activities. 'Mental' ills would be considered as arrested development or regression to one-, or few-valued semantic levels; sanity would be in the other direction; namely, progression conditioned by larger and larger flexibility of conditional and semantic reactions of higher order, which, through infinite-valued semantics, would help adjustment under the most complex social and economic conditions for man.

Substitute for the term 'mental' ills 'bad education' and for 'sanity' 'good education' and you have here a terminology that can be used meaningfully by anyone.

I recommend it especially to the author of the *Fortune* article under examination.

Finally, to discard determinism is to reject the possibility of ordered human progress. We hear today a great deal of talk about freedom of enterprise from those who want freedom from social control. The Italian, German, and Japanese industrialists have great freedom in such a sense when they coöperate with their puppet bullies who wield dictatorial control over their societies. They are the 'independent thinkers' in their countries. But the well-being of the vast majority of us lies in the acceptance of the determinism of the scientifically measurable palpable world. Professor Thorndike stated much the same idea in 'Science and Values' (*ETC.*, I, 11):

> If and as the world is determined, there is hope of controlling it in the interest of human values. Every regularity or law that science can discover in the consequences of events will be a step toward the only freedom that is of the slightest use to man. . . . If values did not reside in the orderly world of nature, but depended on chance and caprice, it would be vain to try to increase them.

Whether we like it and believe it or not, all education, in the widest sense, is the result of conditioning, the result of the impingement of the environment, including hereditary factors, on the individual. If we call methods of education which we dislike by such terms as 'dosing a well-conditioned student,' and if we speak of 'introducing the student to ordered units of thought' when we refer to the type of education which we think supports our social point of view, then we are exhibiting symptoms of either intellectual dishonesty or befuddlement. We are introducing darkness rather than light. And we are illustrating how effectively conditioned we have been, *malgré nous*, by our social prejudices and our linguistic environment. Indeed—to end upon a paradox—the more we are convinced that we 'think independently,' that we are not determined, the more do we become enslaved by our unconscious premises.

Once I was riding on an omnibus, and it stopped for a stoplight. A man stepped off the back platform. A boy in shorts, about 13, jumped from the platform and grabbed the man by the shoulder and yelled, 'This is no bus stop. Come back.' The man looked at him in amazement, and when he saw the boy was in earnest, he said, 'Take your hand off me, or I'll . . .' The bus started to move. The boy tugged at the man, saw he couldn't drag him back, and at the last minute jumped aboard the bus platform. Tears streamed down his face. He looked at the rest of us on the platform and said defiantly, 'It was no bus stop. It was no bus stop.'

STEPHEN LAIRD, 'Nazi Germany after Two Years of War,'
Life, August, 1941.

☆ BOOK REVIEWS ☆

Tied to Grandma[1]

THE USES OF REASON. By Arthur E. Murphy. New York: Macmillan and Company, 1943. $3.

In this book the head of the department of philosophy at the University of Illinois prescribes certain applications of 'reason' to social issues. 'All that reason asks us, here as elsewhere, is to use such knowledge as we can get to the best advantage possible.'

For dealing with questions of fact, Professor Murphy insists on reason in the form of scientific method, and what he says of reason, so defined, is clear and important. But he claims that scientists refuse to tell us whether men and actions are 'good' and whether social policies are 'just,' as he declares they should be if they are to be 'morally rational,' and so he contends that something more than science, some sort of non-scientific 'reason,' is needed for dealing with questions of moral value.

In a peculiarly remarkable statement, he says, for example, 'There is no more reason that the validation of religious belief should conform to canons of scientific verifiability than that the substantiation of moral judgments should do so, save where it is with matters of fact, scientifically verifiable, that such belief is concerned.'

Where it is not with matters of *fact* that such belief is concerned, just what is it concerned with? Professor Murphy seems to say that the distinction he is making is between what is (facts) and what should be (moral values). If calling what should be 'value' takes it out of the realm of fact, to what realm does it take it? And with just what canons of verifiability does one operate in that realm?

Those who insist that science and verifiable data are not enough for dealing with problems of value unavoidably raise the question: What is? After all, scientists can and do investigate values; they ascertain the values men profess to have, the factors associated with their development, and the nature of their consequences. These are questions of fact. If one insists on asking, in addition, whether values and their effects are 'good' and 'just' scientists will be glad to answer that, too, provided only that the kinds of observation needed to answer it are specified.

To say, as Professor Murphy seems to say, that science is unmoral is to jump up and down verbally. It is simply that scientists refuse to answer questions, whether concerning moral values or anything else, until they have seen what observations under what conditions would be relevant. They will gladly answer Professor Murphy's questions about values if only he will so state them as to indicate the relevant data. And if *they* don't answer them it is by no means clear who will, and on what basis.

By the position he assumes, Professor Murphy is led to make a very curious attack on general semantics, which purports to be a *science* of values. In doing so he

[1] A condensed version of this review appeared in Chicago Sun *Book Week*, November 21, 1943.

presents what is definitely the most grotesque assembly of misstatements concerning general semantics that I have yet seen, and I believe I am familiar with practically all the literature on this particular subject. He cites only secondary sources, and the way he cites them indicates that if he ever did read Korzybski's *Science and Sanity*, he must have been listening to Kaltenborn at the same time.

The interested reader is to be referred to pages 70 to 80 of *The Uses of Reason* for the material which has prompted these advisedly strong words. In these ten pages Professor Murphy says somewhat elaborately that the general semanticists advocate the abolition of abstractions, and that they would limit a speaker to statements which refer to something tangible to which he (the speaker) can point! It is to be said for Professor Murphy that after he had created this straw monster he was good enough to demolish it. It was indeed a bad dream, and Professor Murphy should have been sufficiently conscious of his own abstracting to realize—and to warn his readers—that it was *his* dream.

If he actually believed he was referring to general semantics, at least it is hardly necessary to remind readers of *ETC.* that general semanticists do not advocate the abolition of abstractions. They endeavor to make clear the inevitability of abstractions, to cultivate an effective consciousness of the process of making them, to refine the process of abstracting which, being a natural function of the nervous system, can neither be 'abolished' nor disregarded with impunity. Nor should it be necessary to remind anyone who is at all acquainted with general semantics that it does not imply that statements should be restricted to those which refer to the speaker's own direct experience. On the contrary, it is designed fundamentally as a general formulation of the principles of time-binding, the process by which one individual makes use of the experience of other individuals.

In systematizing our knowledge of the basic mechanisms of abstracting and time-binding, the processes of evaluation, Korzybski and his students have simply formulated in general and practical terms the scientific orientation. Except insofar as Professor Murphy attacks that he does not attack general semantics, and it is an act of ordinary fairness to try to make that clear to his readers and to him.

In general, there appear to be four fairly common misconceptions concerning general semantics: (a) it's a study of words; (b) it says that only facts are important and words are useless; (c) it is very abstract and 'intellectual,' ignoring 'emotional' factors; (d) it would abolish abstractions (including metaphorical language). In a way these are amusing, and in time no doubt they will die of their own vapidity. In the meantime they have no legitimate place in works that lay claim to any basis in scholarship.

In summary, Professor Murphy makes a very clear and able statement of the uses of reason, defined as science, as applied to issues of social significance. But he also insists with a dogged petulance on the need for an ill-defined non-scientific 'reason' which he seems to cherish in the name of philosophy. In a word, he loves non-scientific philosophy the way he might love his grandmother, while he loves science as he might love a vivacious girl of whom grandmother does not altogether approve. And toward general semantics and related disciplines he expresses the peculiarity irrational attitude he might feel toward an aunt who insists he should marry the girl even though—or just because—grandma wouldn't like it.

I suspect, to strain the metaphor, that if he would listen more to the aunt he

would find his more effective uses for reason in the ordering of social issues.

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The Vocabulary of 'Emotion'

JOY AND FREUDE: A COMPARATIVE STUDY OF THE LINGUISTIC FIELD OF PLEASURABLE EMOTIONS IN ENGLISH AND GERMAN, by Karl Reuning, Swarthmore, Pennsylvania, 1941.

Theses written by German scholars are not often of particular interest to general semanticists. Germanic studies, deeply rooted in historical philology of the Grimm tradition, usually show little flexibility or interest in things outside of their realm. American Germanists have tried quite often to pioneer in other kinds of research, and European scholars, although puzzled sometimes, have been heeding more and more the courageous voices from the new world. Shortly before I left Germany, one of the outstanding professors of German there remarked: 'Es weht viel frischer Wind in Amerika, und die Germanistik scheint dort neue Bahnen zu brechen'.

Reuning's book is a new venture, a challenge. Scholars particularly interested in Germanic philology will have to consider his statements on Trier's field theory discussed in the first chapter of his book, which comprises almost one-third of the volume. Readers of the *Papers from the Second American Congress on General Semantics,* will recall an earlier paper by Reuning which gave an introductory statement of the position now elaborated more fully in *Joy and Freude.*

Reuning's book attracts a student of general semantics inasmuch as he likes to hear sentences like the following: 'It is a fact that so far no psychologist has presented a satisfactory phenomenological analysis of emotion; such an analysis in my opinion should be based on a study of the l a n g u a g e expressing emotional experience and behavior. The danger of being influenced by aprioristic categories and consequently, of persuading ourselves of things which are not so, are negligible, because psychologists themselves, *e.g.,* K. Koffka, admit that "the psychological theory of emotions is highly unsatisfactory." Among the reasons for this unsatisfactory state of things there seems to be only one that can be appraised by the linguists: confused terminology. One of the most elusive pairs of opposites is subjective-objective, and after having struggled with the definitions of these two words given in a number of psychological and philosophical texts, one is strongly inclined to sympathize with John Ruskin, who said many years ago: "German dullness, and English affectation, have of late much multiplied among us the use of the most objectionable words that were ever coined by the troublesomeness of metaphysicians," namely, "objective" and "subjective." '

Reuning prefers 'directional' and 'non-directional' instead; having thus torn a net of confusion, he penetrates the vast field of German and English words expressing pleasurable emotions.

A few of his many interesting results may be noted: (1) The German Umgangssprache has more words at its command to express great depth of pleasurable emotions, while in English a more or less literary type of word predominates. (2) There are about three times as many English words as German that express definitely shallow feelings. (3) Compared with the German vocabulary of pleasurable emotions, the English vocabulary lacks intensity, and it may be safely

assumed that this is due to differences in the two national cultures. (4) Whereas in German nearly all strongly kinetic words are popular, comparatively many English words of that type are used in refined language only. (5) German has more neutral words of a wider range between excitement and calm; many English words tend to be more static. Reuning emphatically reminds us that the psychology of emotion will remain unsatisfactory until research penetrates the very root of this problem, that is, the language that expresses those pleasurable emotions.

While reading Reuning's book I could not help recalling a striking experience of my own: I took a trip once on a fishing boat to Iceland; being a member of the thirteen-man crew, I had to do the same kind of work they did: setting the net, heaving it in after four hours, chopping fish. I recall that we especially watched the heaving in of the net. The sailors smiled when the catch was good, they smoked their pipes but remained silent. Since this was my first experience, my joy at seeing those fish of all sizes and colors resolved in many words and phrases expressing joy.

The situation turned into its opposite while chopping fish, a task I was doing for the first time. I did not like it too well, but I noticed that my fellow sailors used a most exciting vocabulary while doing that job. Their joy during the cutting (with an underlying sadistic streak) caused them to utter words and combinations of words I had never heard before and have never heard since.

I would suggest to any scientist doing research in this fascinating field of pleasurable emotions to listen to 'language in action' on a fishing boat, when many unusual circumstances not encountered in every day life create good ground for linguistic studies.

F. K. RICHTER
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Did you ever stop to think how words mold science and make it what it is? The scientists who first described electricity as a 'current' forever shaped science in this field. It then quite naturally began seriously to be assumed that electricity was something that flowed through wires as water flows between river banks. Naturally then it had a potential rate of flow influenced by the resistance it met. One term followed another and soon this cloud of symbols veiled the mystery of electricity and we felt that we completely understood it.

It was just a current or fluid. We also understood the atom when we could regard it as a tiny, infinitely hard, indivisible billiard ball; or later as a minute solar system; or later still as a particle of hardened electricity, or a wave motion, or a smoke ring. Then when mathematical symbols replaced those more easily pictured we felt that we had lost something real. The atom was gone. It had vanished. Actually we had never had it in the first place. It was a mental convenience at best.

T. SWANN HARDING, 'Science at the Tower of Babel,'
Philosophy of Science, Vol. 5, No. 3, July, 1938

✯ NEWS AND MISCELLANY ✯

Difference between Water and Ice

ETC. is indebted to Miss Mary Bake of Chicago for the following excellent quotation from Samuel Grafton's column (Chicago *Sun*, November 10, 1943) showing the difference between intensional and extensional attitudes:

'After describing the failure of the German July offensive in the Orel-Belgorod regions, the Soviets say: "The results of the summer battles showed that this new German strategic plan was based on an unreal estimation of the relation of forces, was adventurous from beginning to end and failed disgracefully."

'That is contempt. But it is not contempt on ideological grounds, it is not contempt of the Germans as Fascists. It is professional contempt, the contempt of a good shoemaker for a bad shoemaker. It is detached and objective contempt.

'If you would understand why the Russians have been so successful you could do no better than read that paragraph five or ten times. Everything the Russians have done is in it. Their curious ability to estimate the enemy's forces, without blinking; then to estimate their own, also without blinking; then, to work out, objectively and unemotionally, a policy which precisely fits the relationship between the two, attempting no more than can be done, but no less, either; all this is revealed in the one comment on the Germans. And if you are fortunate enough to see the brilliant new Army film, "The Battle of Russia," you will see this kind of thinking actually pictured on the screen.

'All the world knew, for example, that tanks could beat foot soldiers. The French, as an intelligent people, knew it, and conceded, almost as soon as the tanks appeared. The Russians wondered whether tanks could beat traffic jams in the narrow streets of cities; traffic jams created by foot soldiers hurling hand grenades. It turned out they could not.

'During the first winter of the Leningrad siege, when the city was cut off, the Russians saved the town by building a temporary 100-miles-long railroad on the frozen surface of Lake Ladoga, thus obtaining a supply route. Everybody knows you can't build railroads on water. The Germans knew it. They considered the lake their ally. They depended on it. But what of water when it becomes ice? The freezing of the water had introduced a new factor into the situation, and the Russians took precise, methodical, objective advantage of that new factor. The profound difference between water and ice had escaped the Nazis.'

Checking Symbolic Operations

S. A. Nock, vice-president of Kansas State College, Manhattan, Kansas, has written an important article on 'The Scientists and Ethics' in the October, 1943 issue of *Ethics* (Vol. LIV, pp. 14-28). The following excerpt is of special interest to readers of *ETC.*:

'For some reason, pragmatism has an evil name. Perhaps this is because it is not a matter of words but a matter of checking, and checking lacks mystery in the popular mind. Possibly this attitude is merely a reflection of the old Christian notion that this is a world of sin and

tears and that what really counts is the Other World—whatever that may be. Pragmatism lacks approval of authority, perhaps; yet we cannot deny that what works, works.

'One society of individuals in our world works. It has long worked, and it continues, in spite of all kinds of obstacles, to work. Because it works so well and makes so little of itself, because its results are so much more easily understood than itself, this society of individuals has not been generally appreciated for what it is.

'It is a society of individuals whose activities contribute to the welfare of the society as a whole and to the welfare of each member of the society. In doing his own chosen work, in living his own life, each member of the society does what he has chosen to do, with considerable success, and at the same time makes the work of every other member of the society easier and more interesting.

'This is the society of science. It works because those who constitute it have evolved a system of values that make it work. They have found and they practice those values that contribute to the welfare of the individual in society and to the welfare of the society of individuals.

'These values are not abstruse and difficult of comprehension either. We all know about them, by hearsay at any rate; and we all approve them. But we don't practice them, perhaps because we are deafened by the din of talkers or perhaps because we don't think about them. Whatever the reason for our neglect, we may best stop neglecting them. The first step in that direction is to see what they are and why they work for the scientist.

'Even before that, however, we must see who the scientist is, because if he is what we have so often been told we shall be wasting time. Whatever may work for fellows like that is of no importance to us. Scientists, however, are not fellows like that. We must eliminate the pedants, the technicians, the hacks, and look at the scientists. Then we shall find that it is not matter but method that makes the scientist. Not what he works with, but how he works with it, determines the status of a man in the society of science. Little or large, living or dead, human or unhuman, materials are there for the scientist. It is his approach to his problem, whatever it may be and whatever it may deal with, that makes the scientist and sets him off from others.

'The scientist is one who pursues inquiry in the light of hypothesis, performing symbolic operations as a means to solving his problems, but checking his symbolic operations against nonsymbolic facts before assigning validity to any conclusions.

'Exceptions occur to the mind at once. For instance, the definition is too much for the pure mathematician, who never gets beyond symbols: his checks are wholly symbolic. On the other hand, he claims no validity for his conclusions beyond the symbolic system in which they appear. Limited by definition, the mathematician is rigorous in pursuing his inquiry. Except that his context is negligible, he works like another scientist. . . .

'Our scientist is one who employs scientific method in his thinking: he pursues inquiry in the light of hypothesis. He doesn't merely fuss with things haphazardly, nor does he work out the problems of the universe in his armchair. He operates symbolically but never considers the logic of symbols alone sufficient to establish nonsymbolic validity. He states his assumptions as far as he is able to recognize them, and he is ever on the

lookout for assumptions that have escaped his scrutiny. He states his postulates and states them as postulates. He attempts to give meaning to such terms as he uses by making clear the operations required to arrive at such terms: the meaning of his terms is the operations required to arrive at them. His propositions, as far as he can make them, are investigable beyond the language in which they are stated. . . .

'There is much that the scientist has not uncovered or explained, which is to say that the world is a pretty big and complicated affair. The scientist has, however, found out how to continue investigation of whatever he decides to investigate. Those who say that his method is invalid here or there are simply saying that what they are talking about is incapable of investigation.

'To assert that any thing, any activity, any phenomenon is not investigable is to claim omniscience. If one makes such an assertion without attempting all methods of inquiry, one is merely talking—unless one has been directly inspired. If one makes such an assertion after exhausting all known means of inquiry, one is simply saying that the nut isn't yet cracked, or else that there has been failure in method.

'In spite of superstition to the contrary, the scientist is willing to consider any method of inquiry that will help him to find out what he wants to know. He insists only that there be some way of checking the method to make sure that it is a method of inquiry.

'There is, for instance, no method of checking purely verbal logic against anything else. One may build up a magnificent and very moving system of verbal thinking, but no one can check Plato's doctrine of the Idea or the existence of the Germanic Absolute. If you postulate separation from the world of the senses, you automatically eliminate possibility of checking the results of your manipulation of symbols. The mathematician does this and accepts the consequences.

'Whether or not purely verbal constructs are useful depends not on whether they have meaning but on whether they stir to action. If they do so stir, then they are to that extent investigable by one using scientific method: a scientist may investigate the phenomenon of action following words. Yet if he tries to do so, he is often cried down as a sordid grubber, making a dirty laboratory specimen of the highest exaltation of mankind. Since the scientist cannot see that this talk means anything much, he can only go on with what he is trying to do. He can only pursue his inquiry to the best of his ability. He may fall far short of explanation and elucidation. Yet we must remember that he has made fairly clear what goes on in revival meetings, even if he has failed to expound saintliness. We need not, however, object if he tries to find out what makes saints, for we could use many more than we are customarily blessed with.

'To investigate human phenomena takes courage. Once it took courage to investigate stars, and then to investigate other physical facts. Then biological facts were a danger to the inquiring individual, and then it was dangerous to investigate contagious diseases. It still takes courage to investigate human conduct that has got talked about in a different and solemn tone of voice.'

'Training the Intellect'

The following problem is quoted verbatim from an examination in a course in 'Logic' at a large middle-western university. Readers who undertake to solve

the problem are asked *not* to send in their solutions to the editors of *ETC.*

'Diagram and criticize: If apes either bark or sing, dogs must either whistle, yodel, or whine. Now, if dogs whistle, then they either fiddle or flute; but they cannot fiddle, because only yellow objects fiddle, and they cannot flute because only red objects do that. Again, they cannot yodel, because only Tyroleans yodel, whereas no dogs are Tyroleans. Finally, therefore, they possibly whine. But since all who whine either dance or swim, and since no dogs can do either, they cannot whine. Therefore apes neither bark nor sing; and since the only remaining things they can do would be to paint pictures or talk on the telephone, it follows that apes either paint or telephone, and thus they have the peculiar skull structure which we associate with apes.'

Figures of Speech

The following is an excerpt from a report on the use of general semantics in the study of figures of speech by Rebekah J. Baron, teacher in the Denver, Colorado, high schools:

'In training beginning students in literature courses to recognize, understand, and use figures of speech I have found three steps useful. Students are asked first to see the difference between words which are intended to be used in the "ordinary, everyday" manner and those that can be called "imaginative." Even in a story about imaginary people there is this difference. The figures of speech belong on a different level of abstraction from the words intended to be taken "denotatively." Some students do not progress beyond this stage, but they like to read better than they did before they could make this distinction, and they understand more of what they read—even with only this degree of skill. The second step is taken when students begin to be able to tell what the imaginative language is trying to do, what effects it tries to produce (comparison, contrast, abstraction of details, imitation of the sound, etc.). Some students do not go beyond this. *After* these skills begin to develop some students can add the label—"simile," "antithesis," "metonymy," etc. Since the name represents a higher order of abstraction, it does not come first in order of importance. The students learn that the name is intended to be used as a convenient way to refer to the process included in the first two steps. But the name is not allowed, as is so often the case, to block the comprehension of the process. The process is considered more important than the name. If there is too much difficulty in pronouncing, spelling, or remembering the name, its use is not required. What does it matter if, without the label, more words are needed to tell about the figure?

'Those who use the names find that some uses of figurative language refuse to be labelled. Figures do not always fit the pattern exactly. What then? They remember that we do not know all about anything. These figures are enjoyed without having to be labelled. And some figures can be called by either of two names, as "metaphor" or "personification." Sometimes a few words contain several figures at once. These conditions can add interest to the experience of finding figures.

'There are indications that skill in connection with figures of speech can produce better integrated "thalamo-cortical responses" to words than occurs when reading is done without making these distinctions and asking why such language is used. Such skill can bring about better evaluation of what the author is trying to say, more effort to understand

what the author was abstracting when he used the words, etc. In writing compositions there can be less imitation, less "blockage," more use of the student's individual experiences. As yet I have not found much "conscious" use of figures in oral work, but perhaps, if I am predicting on the basis of adequate evaluation, eventually there will be progress in this respect too.'

Experiment in Total Education

The following has been received from Kenneth S. Keyes, II, co-director of the institute described in the announcement. Mr. Keyes invites comments, criticisms, and suggestions.

'The Institute for Non-Aristotelian Research and Education is now beginning an educational experiment in which a group of children (*sans* parental relationships) will be reared and educated. All children will be under two years of age when adopted by the Institute. The group will eventually consist of ten or more individuals—enough to form a lively community of thought and activities. The Institute has a forty-five acre tract about twenty-five miles from Miami, Florida. In this moderately settled grove land, influences from playmates and individuals outside the group will be subject to a large degree of control.

'All education through high school and, with some individuals, college levels will be supervised by the Institute. Laboratories and workshops will be equipped, and instructors in sciences, arts, and manual techniques will be provided. Students interested in graduate work beyond the training of the instructors of the Institute will be sent to universities.

'The individuals will be thoroughly trained in scientific attitudes and methods, including general semantics and non-aristotelian orientations. They will be trained to acute awareness of structural relations between words and facts. In order that these individuals will be better prepared to create new formulations, care will be exercised to avoid indoctrination in a *belief* in the formulations presented — rather, the nature of higher order abstractions and the evidence that supports the hypotheses and doctrines of science, philosophy, etc., will be stressed. Many experiences will be provided which will develop an understanding of the personal, social, economic, etc., problems that will confront them in this world. As soon as it is believed the children have been "immunized" to certain undesired responses, associations with individuals outside the group will be provided.

'It is intended that this experiment will demonstrate a surprising development of "mind" and "body" that can take place in young children when they are stimulated by an environment encouraging self-realization. The pleasures of understanding, and the satisfactions of increased control over one's environment that knowledge affords will be used to motivate habits of study and reflective thought. One of the most fundamental problems of this experiment will be the motivation of independent study — independent in the sense that students will be helped and encouraged, but not driven or requested to study by teachers. We hope to stimulate in these individuals an attitude of "adventurous conquest" toward learning.

'This project offers an excellent opportunity for the experimental creation of a "culture." Attitudes toward happiness, self-control, fellow man, racial minorities, sex, religion, etc., etc., will be subjected to reflective thought by the educators of the Institute and only those attitudes con-

sidered appropriate for intelligent and learned individuals will be encouraged.'

News of the Society

The following were elected officers in the Society of General Semantics in the election held last November and December:

President: CHARLES B. CONGDON, M.D., Psychiatrist, Student Health Service, University of Chicago; member of attending staff, Cook County Psychopathic Hospital; Assistant Clinical Professor of Neuro-Psychiatry, Loyola University Medical School; Diplomate, American Board of Neurology and Psychiatry; Trustee, Institute of General Semantics.

Secretary-Treasurer: KARL G. HAUCH, Executive Director, Chicago Hospital Council; Secretary (through period of organization), Society of General Semantics.

Directors: RAYMOND W. MCNEALY, M.D., Chief Surgeon, Wesley Memorial Hospital; Professor of Surgery, Northwestern University Medical School; Trustee, Institute of General Semantics. S. I. HAYAKAWA, Ph.D., Associate Professor of English, Illinois Institute of Technology; MRS. CARL M. PLOCHMAN, Evanston, Illinois, Assistant Executive Secretary (through period of organization) of Society of General Semantics. EDWIN S. HEWITT, life insurance counsellor and broker; President, Edwin S. Hewitt and Associates. THOMAS D. ELIOT, Ph.D., Professor of Sociology, Northwestern University. ELSIE SMITHIES, M.A., Assistant Principal, University of Chicago High School.

There are now almost 250 members in the Society for General Semantics. Members should have received by now, in addition to Volume I, Numbers 1, 2, and 3 of *ETC.*, a copy of 'Race and Words,' by S. I. Hayakawa, reprinted from the July, 1943, issue of *Common Sense.* Charter Members (who joined in 1942 and got the Society started) have received, in addition to the above, a copy of General Semantics Monograph III, *A Theory of Meaning Analyzed*, by Thomas C. Pollock, John G. Spaulding, and Allen Walker Read. The first membership period expires June 30, 1944.

Any members who have not received all the publications due them will kindly notify the Secretary-Treasurer. 'Race and Words' is now out-of-print, but additional copies have been ordered. They will be obtainable from *ETC.* at 20 cents a copy; 10 cents in lots of twenty or more. Reprints of Thorndike's 'Science and Values,' and Bloodstein's 'General Semantics and Modern Art' are also still available at 25 cents a copy; 15 cents in lots of twenty or more.

Staff Changes on ETC.

Dr. Henry J. Webb, Assistant Editor of *ETC.* since its foundation, went into the armed forces in January and is now stationed at Camp Wheeler, Georgia. His editorial skill, which contributed in no small measure to the success of Numbers 1 and 2, will be sorely missed. Dr. F. K. Richter, Assistant Professor of Modern Languages, Illinois Institute of Technology, has been appointed Assistant Editor to replace Dr. Webb.

Dr. Sanford B. Meech, Associate Professor of English, Illinois Institute of Technology, and formerly Associate Editor of the *Middle English Dictionary*, and Dr. Charles B. Congdon, President of the Society for General Semantics, have consented to serve on the editorial board as Associates.

Future of the Institute

Before the Institute of General Semantics could make any wide appeal for financial support, it was felt that general semantics ought to 'produce the goods.' The Institute has had to date a remarkable record of independence of the usual sources of aid. Because it was pioneering in a new science it has had to care a great deal about producing results and very little about academic and official approval—or disapproval. It has had to work outside the 'safety zone' of academic and scientific orthodoxy, without the security of endowments or grants or affiliations with other institutions. (Apparently it must continue to have minimum expectations about such sources of security for some time to come.) It has carried on without a group of wealthy backers and without fund-raising programs. All its contributed income (which has constituted about two-thirds of its total income, the rest coming from tuition fees and the sale of literature) has come without solicitation from those who have *studied* general semantics.

Now, however, that the publication of *Papers from the Second American Congress of General Semantics* has made the results of the first five years of research and application a matter of public record, the Institute is making a general appeal for financial contributions from people who have, in one way or another, benefited from the study of general semantics.

Contributions (deductible for income tax purposes, of course) can be made either directly to the Institute of General Semantics (1234 E. 56th St., Chicago 37), or else by means of membership in the Society for General Semantics (Karl G. Hauch, Secretary, 105 W. Adams St., Chicago 2). [All sums over $5 a year (minimum membership dues: $10 a year) paid as dues to the Society for General Semantics is contributed by the Society to the Institute. The $5 retained by the Society pays for a subscription to *ETC.*, for other publications selected by the Directors for distribution to the members, and for Society activities.]

Seminar and Workshop

At the suggestion of many who have taken seminars at the Institute of General Semantics, the next seminar, scheduled for July 6 to July 28, 1944, will take a slightly different form. During the first ten days there will be lectures by Korzybski, afternoons and evenings, as in past intensive seminars.

During the remainder of the period, M. Kendig, educational director of the Institute, will be in charge of a 'workshop,' in which applications of general semantics to specific fields will be discussed, sometimes by the entire group, sometimes in smaller groups—with free exchange of opinions and information among all those taking part. Judging by the people who have already expressed their intention of taking part in the Seminar and Workshop, it appears that special sessions will probably be held to discuss the application of general semantics to such fields as the following: English literature and composition, the teaching of science, mental hygiene and psychosomatic medicine, journalism, race relations, management and personnel, consumer coöperatives, problems of primary and secondary education, law and economics. Guest speakers are also scheduled, who will give special lectures, moving pictures, and demonstrations. Further information may be secured from M. Kendig, Institute of General Semantics.

✡ CORRESPONDENCE ✡

How to Tame an Earthquake

SIR: To anyone who is doubtful about the process nature of reality I recommend the experience of an earthquake. I am one of a number of soldiers who witnessed one some time ago on an island in the Southwest Pacific. One morning just as dawn was breaking I became conscious of a very gentle shaking, as if some animal, or an involuntary rhythmic movement of my body, was setting my cot in motion. The shaking gradually grew more and more violent, and at last I realized with alarm what was causing it. My cot was now swaying about with abandon. The solid ground suddenly seemed nothing more than a soft, jelly-like mass in agitation. The tremor continued for several minutes. There was no opening or dropping of the earth, and gradually the shaking subsided. From then on, for the remainder of the time we were on the island, we were intermittently aware of small swayings and oscillations underfoot. The sensation was a source of continual anxiety to most of us.

The experience of an earth that fails to live up to its reputation for hardness and solidity is a painful semantic shock. Many of us were troubled by fantasies of the earth suddenly opening, or the island sinking into the sea. It seemed evident, as the tremors continued to occur day by day, and there was no cataclysm, that these fantasies were partly the result of inappropriate semantic reactions to a new and disturbing environment. Out of sheer necessity, I attempted to probe these semantic reactions and to draw a more accurate map of the infirm territory on which we found ourselves.

To begin with, a number of facts soon gained particular significance. First, it developed that a number of men had experienced a slight, inexplicable shaking of their cots at night at various times since coming to the island. In the second place, there was marked disagreement among individuals as to the number of shocks that took place during a certain period after the earthquake. After a careful study of my sensations I became convinced that the earth beneath us was unceasingly in motion, however slight—a motion difficult to detect when standing or walking, less difficult when sitting. It could almost always be felt distinctly when lying down. Finally, I recalled that the seismograph gave evidence everywhere of continual tremors too small for human sensation. Briefly, I re-learned the dynamic geology of the textbook on a lower level.

For many of us the significance of these facts had been obscured by a fog of inaccurate verbalizations reflecting identifications of the label 'ground' with high order abstractions labeled by the words 'hardness' and 'solidity.' There was a strong tendency toward two-valued evaluation of an earth that seemed stationary as 'normal,' and an earth whose movement could be felt as 'abnormal.' The innocuous verbal reaction, 'There it goes again,' gave repeated evidence of this two-valued orientation toward an infinite-valued phenomenon, and suggested the necessity for inventing new

verbalizations. It became interesting and, I think, beneficial to toy with such expressions as 'The ground is calm as a lake this morning,' or 'That was a rough ground we had last night.'

In general, I succeeded, by placing observation before words, in correcting the reversed order of evaluation that had caused so much pained indignation at a ground that didn't behave as ground 'should.' These simple re-orientations dispelled the catastrophic fantasies entirely, and gave me much greater self-possession during a heavy 'land.'

OLIVER BLOODSTEIN
Somewhere in the
Southwest Pacific

Contexts

SIR: I have read with interest Wendell Johnson's 'You Can't Write Writing' [*ETC.*, Vol. I, No. 1, pp. 25-32.] . . . and note his quotation from my analysis of Herrick's 'Corinna's Going a-Maying' . . . He quotes:

> The theory of communication throws the burden of proof on the poet, overwhelmingly and at once—the reader tells the poet: here I am; it's your job to get it across to me—when he ought to be assuming the burden of proof himself. Now the modern poet has thrown the weight of responsibility on the reader.

Dr. Johnson comments: 'I have quoted Mr. Brooks because he has succeeded in stating with unusual conciseness this strange notion that the writer is properly under no obligation to be communicative.'

I do not think that Dr. Johnson's inference is justified, even if the sentences quoted are in isolation from the rest of the context. Some weight ought to be given to the phrases 'burden of proof' and 'weight of responsibility' and to the adverb 'overwhelmingly;' and a semanticist ought to be the very man to be alive to these considerations.

But the sentences quoted were not printed in isolation, and Dr. Johnson did not find them in isolation . . .; they occur in an essay which examines some of the subtleties of a very tightly organized poem, and far from arguing that the poem communicated nothing, I argued that the poem communicated so much that the usual paraphrases distorted what was said, and that if we wanted to be precise about it, what the poem said was strictly unparaphrasable: one had to read the poem himself.

Dr. Johnson himself apparently has a few twinges of semantic conscience. He hastens to say: 'I do not wish . . . to be understood as saying that a reader has no obligation to try to meet a genuinely original (and therefore difficult) writer half-way, for obviously many writers and poets, dissatisfied with the clichés of their time and trying to create new ways of feeling . . . must necessarily rely upon the reader's willingness to accept a revised vocabulary of an unfamiliar set of symbols. But this is a problem only in extremely advanced levels of artistic composition.'

But what else did Dr. Johnson take me to be talking about? Or is his point that Herrick's poem is not a 'genuinely original' poem? I quite agree with him that it is impossible to 'write writing,' and I am happy to see him emphasize the point. But to urge the point that one can't 'write writing' by demonstrating that one cannot (or will not) read writing is scarcely to recommend it.

CLEANTH BROOKS
Louisiana State University

The Author Replies

DEAR PROFESSOR BROOKS:

Your good letter to Dr. Hayakawa . . . indicates that we have to deal with a peculiar situation in which you object to my having lifted the passage in question from the context you had given it—and I object to your wanting to lift it from the context which I gave it. It goes well in both contexts. It does not, of course, make the same sort of sense in both.

I trust no one will infer that I was passing judgment on your analysis of Herrick's 'Corrina's Going a-Maying,' or on the use you made of the passage in question in connection with that analysis. It might be well, nonetheless, to invoke the old slogan of caution: I say what I say, I do not say what I do not say. In 'You Can't Write Writing' I said only that, in the sentences quoted, you had succeeded in stating with unusual conciseness the notion that the writer is properly under no obligation to be communicative. You had—in the sentences quoted—and so they illustrated well a point I wanted to make. I was not searching for a context from which to lift the sort of statement I wanted; I had the context, and I was merely looking around for a particular kind of statement to put into it. Yours happened to fit.

Having lifted the passage from your context and placed it in my own, I did hasten to say in effect, as you pointed out, that the reader does have some obligation to try to meet a genuinely original writer half-way. There was no 'twinge of semantic conscience' involved in doing this, so far as I am aware, any more than there was, so far as I am aware, in your making the same point essentially in your *Prefaces* article. It is a good point, whether you or I make it, and we might both suffer a 'twinge of semantic conscience' if we should fail to take note of it. It happened to be the main point you were making and, I feel, rightly so; it happened to be a qualification of the main point I was making. We were writing about different kinds of writing.

. . . Since I did neglect to mention in 'You Can't Write Writing' that my qualification was your main point, legitimately made with reference to the 'advanced levels of artistic composition' you were discussing, I do owe you an apology for inadvertently implying that *in your context* the sentences in question were inept. I can only plead that I was too close to the pencil. Your letter has done me, and I hope my readers, too, the service of indicating that my qualifying statement was not quite sufficient to the purpose for which it was made. I would hardly be a semanticist if I did not appreciate that kind of service.

I shall be pleased if this reply to your letter might be as clarifying in its way, also. You will recall that in my article I said that just as one cannot write writing, so one cannot read reading. I made some point of this. It needs a more extended treatment, and one reason it does is suggested by your letter. The point is that when a reader encounters a statement that has been lifted from one context and transplanted to another, he is under some obligation to evaluate the statement with reference to the context in which he finds it. People who chronically insist that writers misuse words, defending their assertions by quoting the dictionary, illustrate what I mean. This takes back no part of my apology, nor does it imply any justification of writing writing. It argues simply for an adequate degree of conditionality in the reader's reactions to words and statements. Anything the writer can do to stimulate that

conditionality in the reader is to the good. I assumed I had done what I could in 'You Can't Write Writing.' You indicate that I should have done more. I believe I should have.

WENDELL JOHNSON
The State University of Iowa

Formal vs. Functional Grammar

SIR: I have just read with great interest the article in *ETC.* entitled 'You Can't Write Writing.' . . . I think you handle the main issue of a formalistic versus a functional approach [to English composition] admirably. . . .

The other day I had an argument with a professor for whose brains in general I have most hearty respect. The problem was not the fundamental one, but one closely allied to it: whether grammar is pattern and logic or function, *i.e.*, whether it is laid down by God and the schoolmarms or determined by the effectiveness of expression as applied to the particular situation. I am afraid I was worsted, though much less by the cogency of my opponent's arguments than by his vehemence and adeptness in shifting ground, and particularly by his highly developed faculty of interrupting me in a voice somewhat louder than my own before I could even edge in a riposte. 'We've got to have standards!' he shouted. 'Wait until your boy comes home some day saying, "Me and Bill has been swimming." ' And much more of the same. He exhumed the old, dead red herring of 'ain't' and slew me with the terrible stench, and argued (for once justly) that the cheap journalists who annually make the AP dispatches with defences of 'ain't' should be incarcerated. But after he had done me in so thoroughly and completely by means of these and similar devices, after I was left limp and speechless and trodden into the mire by the crowding hosts of his immense vocabulary, he finally remarked, 'Christ, these little bastards around here are so goddam dumb that you can't pound good grammar into their heads with a hammer.' I think I'll keep that by me. Someday four or five years hence I may take a crack at (a) the schoolmarm's influence on English and (b) writers of college handbooks as models for the effective use of English. Have you ever been through the desert regions of those textbooks? Understand, you've gotta say, 'The man shot the woman whoM he married' in preference to 'The man shot his wife.'

I hope that time may bring a clear cleavage in our ranks and that the formalists and the functionalists may come to an exciting pitched battle. Not until one has occurred is there much hope that straight thinking can make any great amount of headway. The saddest part of all is that most of the formalists do not even recognize themselves as formalists: if one speaks of teaching organization they . . . say, 'Why, isn't that just what we've been doing all along?'

ANDREW J. GREEN
Louisiana State University

Having Something to Say

SIR: I have read the article, 'You Can't Write Writing,' with a great deal of interest and, I hope, with some profit. With most of it I am in hearty agreement; with little of what is said am I, as an English teacher, disposed to quarrel. I suspect, however, that Professor Johnson's success in teaching graduate students to write is in large part due to the opportunity for *individual instruction*—an opportunity too seldom offered to or taken by instructors in large freshman classes. It is, I believe, only by individual instruc-

tion that real progress in composition can be realized.

Possibly he correctly interprets the view of many English instructors that one cannot be taught to write. I think, however, that many who have stated that view have meant that one can never write successfully unless he has something to say—that correctness is never a substitute for original thought. With that interpretation I know he would agree.

I am passing the article along to those in charge of Freshman English with the request that they read it.

BALDWIN MAXWELL
State University of Iowa

A 'Classic' Remark

SIR: I happened not long ago to be talking to one of those pompous 'authorities' who 'have known all about general semantics right along and have been practising, by different names, those very same principles for years.' The conversation turned into a carping 'argument' *pro* and *con* general semantics, as any such conversation with such a person seemed to descend. On this occasion, this particular learned opponent of general semantics came out with what will perhaps become a classic remark on the subject: *'Has anyone ever analyzed Aristotle from a general semantics standpoint?'*

This, believe me, is a direct quotation, and from a person supposedly well-read on the subject, and who had on other occasions accused the method of 'over-verbalization,' 'creating a new terminology for long-known principles,' 'stating as newly-discovered truths things that had been known for years,' as well as making all other charges that have been the mainstay of the bulk of the anti-semantic literature. . . .

BENJAMIN NEWMAN
Brooklyn, New York

Etcetera and Et Caetera

SIR: It is a great pleasure to congratulate you on the quality of *ETC.*, Vol. I, No. 1. Professor Johnson's article, in particular, dealt very effectively with an important and too much neglected aspect of English teaching.

I am enclosing . . . an ancestor of Cummings' poem [*ETC.*, I, 24]. I thought you might like to reprint it in your next issue.

JOHN L. SWEENEY
Cambridge, Mass.

A SONG. ET CAETERA

By John Wilmot, Earl of Rochester
(1647-1680)

In a dark, silent, shady Grove,
Fit for the Delights of Love,
As on Corinna's Breast I panting lay,
My right Hand playing with Et Caetera.

A thousand Words and am'rous Kisses,
Prepar'd us both for more substantial Blisses;
And thus the hasty Moments slipt away,
Lost in the Transport of Et Caetera.

She blush'd to see her Innocence betray'd
And the Small Opposition she had made;
Yet hugg'd me close, and with a Sigh, did say,
Once more, my Dear, once more, Et Caetera.

But, Oh! the Power to please this Nymph was past;
Too violent a Flame can never last;
So we remitted to another Day,
The Prosecution of Et Caetera.

BOOKS RECEIVED

[Mention in this section does not preclude the possibility of more extended notice in subsequent issues.]

BROWN, LOUISE FARGO. *Apostle of Democracy: The Life of Lucy Maynard Salmon.* Harper and Bros., 1943. $3.50.

CAIRNS, HUNTINGTON. *The Theory of Legal Science.* University of North Carolina Press, 1941. $2.

CARNAP, RUDOLF. *Formalization of Logic.* Harvard University Press, 1943. $3.

CHASE, STUART. *Where's the Money Coming From? Problems of Postwar Finance.* Twentieth Century Fund, 1943. $1.

COBB, STANLEY. *Foundations of Neuropsychiatry* (2nd ed. of the work formerly known as *A Preface to Nervous Disease*). Williams and Wilkins, 1941. $2.50.

FAIRCHILD, DAVID. *Garden Islands of the Great East: Collecting Seeds from the Philippines and Netherlands India in the Junk 'Cheng Ho.'* Scribners, 1943. $3.75.

FARBER, MARVIN. *The Foundation of Phenomenology: Edmund Husserl and the Quest for a Rigorous Science of Philosophy.* Harvard University Press, 1943. $6.

FINK, DAVID HAROLD. *Release from Nervous Tension.* Simon and Schuster, 1943. $2.

HOGBEN, LANCELOT, editor, and FREDERICK BODMER. *The Loom of Language.* W. W. Norton & Co., 1944. $3.75.

HOLT, RACKHAM. *George Washington Carver: An American Biography.* Doubleday, Doran, 1943. $3.50.

JAMES, GLENN. Assisted by Robert James. *Mathematics Dictionary.* The Digest Press, 1943.

KRAINES, SAMUEL H. *The Therapy of the Neuroses and Psychoses: A Socio-Psycho-Biologic Analysis and Resynthesis.* Lea and Febiger, 1943. $5.50.

KRAINES, SAMUEL H. and THETFORD, E. S. *Managing Your Mind: You CAN Change Human Nature.* Macmillan, 1943, $2.75.

PAGE, IRVINE H. *Hypertension: A Manual for Patients with High Blood Pressure.* Charles C. Thomas, 1943. $1.50.

PRESTON, GEORGE H. *The Substance of Mental Health.* Farrar and Rinehart, 1943. $1.75.

ROBERTS, HOLLAND D., KAULFERS, WALTER V. and KEFAUVER, GRAYSON N., (Editors). *English for Social Living: A Program Including 25 Statements of Practice by Teachers in the Field.* McGraw-Hill, 1943. $3.50.

STANFORD UNIVERSITY SCHOOL OF EDUCATION FACULTY. *Education in Wartime and After.* D. Appleton-Century Co., 1943.

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